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Contents

Volume 64 2007

- 1 > A new pipefish, *Stigmatopora narinosa* (Syngnathidae) from South Australia
Robert K. Browne and Kevin Smith
- 7 > Description of *Amischa paolettii* sp. nov. and *Thamiaraea tsitsilasi* sp. nov. from the Australian region (Coleoptera, Staphylinidae)
Roberto Pace
- 13 > New genera and new species of the subfamily Aleocharinae from Australia (Coleoptera, Staphylinidae)
Roberto Pace
- 23 > New cucumariid species from southern Australia (Echinodermata: Holothuroidea: Dendrochirotida: Cucumariidae)
P. Mark O'Loughlin
- 35 > New Holothuria species from Australia (Echinodermata: Holothuroidea: Holothuriidae), with comments on the origin of deep and cool holothuriids
P. Mark O'Loughlin, Gustav Paulay, Didier Vandenspiegel and Yves Samyn
- 53 > New apodid species from southern Australia (Echinodermata: Holothuroidea: Apodida)
P. Mark O'Loughlin and Didier Vandenspiegel
- 71 > A new fissiparous micro-asteriid from southern Australia (Echinodermata: Asteroidea: Asteriidae)
Milena Benavides-Serrato, P. Mark O'Loughlin and Chris Rowley
- 79 > A new species of *Colossendeis* (Pycnogonida: Colossendeidae) together with records from Australian and New Zealand waters
David A. Staples
- 95 > *Pycnogonids* (Arthropoda: Pycnogonida) from the Great Australian Bight, southern Australia, with description of two new species.
David A. Staples
- 103 > Notes on *Candelabrum australe* Briggs, 1928 (Hydrozoa, Anthoathecatae)
Jeanette E. Watson
- 107 > New apseudomorph tanaidaceans (Crustacea: Peracarida: Tanaidacea) from eastern Australia: Apseudidae, Whiteleggiidae, Metapseudidae and Pagurapseudidae
Magdalena Blazewicz-Paszkowycz and Roger N. Bamber

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A new pipefish, *Stigmatopora narinosa* (Syngnathidae) from South Australia

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Abstract

Browne, R.K. and Smith, K. 2007. A new pipefish, *Stigmatopora narinosa* (Syngnathidae) from South Australia. *Memoirs of Museum Victoria* 64: 1–6.

A new species of pipefish, *Stigmatopora narinosa* sp. nov. (Teleostei, Syngnathidae) is described from Gulf St. Vincent and Spencer Gulf, South Australia. *S. narinosa* shares with the other three described *Stigmatopora* species a similar fin placement, fully enclosed brood pouch, superior and inferior trunk and tail ridges continuous, a lateral trunk ridge ending midlaterally. *S. narinosa*, *S. nigra* Kaup, 1853, and *S. argus* Richardson, 1840, have long prehensile tails and all *Stigmatopora* lack caudal fins. *S. narinosa* is most similar in meristics to *S. nigra* in having the dorsal fin initiating on about the fifth to seventh trunk ring and the lateral trunk ridge terminating across the second tail ring. In other *Stigmatopora* species the dorsal fin originates on the ninth to thirteenth trunk ring, the lateral trunk ridge terminates between the eighth to thirty-second tail ring, *S. narinosa* is distinguished from sympatric *S. nigra* in having nine (range, 8.2–9.8), rather than six sub-dorsal tail rings (range, 4.8–7.1), a greater number of sub-dorsal tail and total rings, a greater number of dorsal-fin rays, a shorter laterally flattened and dorsally elevated snout, a distinct banded pattern in both live and preserved specimens, a larger brood number and a double layer of eggs in the brood pouch. The brood pouch is under the anterior portion of the tail and extends for 15–18 rings from the anal ring; pouch plates are absent or vestigial, and the folds of the semi-pouch enclosure meet on the ventral midline. The eggs are deposited in up to two layers, one lining the dorsum of the pouch and the other separated by a membranous partition, and the brood of up to 98 eggs is larger than the maximum number of 41 found in *S. nigra* and *S. argus*. *S. narinosa* young at birth are approximately 18 mm, *S. nigra* 13 mm, and *S. argus* 32 mm total length. *S. narinosa* has a very restricted known range and habitat, inhabiting patchy open beds of sea-grasses with brown algae on sandy rubble substrate between 1 m and 5 m depth over less than 200 km of coastline.

Keywords

New species, syngnathid, marine, *Stigmatopora narinosa*, taxonomy, *Stigmatopora nigra*.

Introduction

In 2003, we examined syngnathids in the South Australia Museum collection to collect data on range, brood size, and different brood morphologies. Among the specimens were several examples of a *Stigmatopora* sp. with a unique sub-dorsal tail ring count, snout shape, and coloration. The earliest of these was collected in 1964. In the collection these were identified as *Stigmatopora* sp. or unnamed, with several specimens lacking accession numbers (Browne, 2003).

The Southern Australasian genus of pipefish the *Stigmatopora* was first described by Kaup (1853). *Stigmatopora* shares with the more tropical *Syngnathoides* Bleeker, 1851 and *Solegnathus* (*Runcinatus*) Whitley, 1929 confluent inferior ridges and superior ridges, dorsal-fin origin on the trunk, absence of a caudal fin, presence of pectoral fins in adults and a lateral trunk ridge ending without a ventral deflection. These genera differ through the positioning of the male brood region

beneath the tail in *Stigmatopora* and *Solegnathus* (*Runcinatus*) rather than beneath the trunk in *Syngnathoides* (Dawson, 1982) and the development of a semi-pouch enclosure in *Stigmatopora* compared with unprotected membranous compartments in *Syngnathoides* and *Solegnathus* (*Runcinatus*) (Dawson, 1985). When preserved *Stigmatopora* lacks the distally coiled prehensile tail found in representatives of both *Syngnathoides* and *Runcinatus* (Dawson, 1982). Nevertheless, we have observed *S. narinosa* sp. nov., *S. nigra* Kaup, 1853, and *S. argus* Richardson, 1840 holding seaweed with their prehensile tails (fig. 1).

Dawson (1982) reviewed *Stigmatopora* and found considerable differences in meristic values between populations within the three recognized species: the Australian and New Zealand *S. nigra*, the Australian *S. argus*, and the New Zealand *S. macropterygia* Duméril, 1870. Despite the variation, *S. nigra* was distinguished from the other two *Stigmatopora* spp. by its dorsal-fin origin on the fifth to seventh trunk ring

and the lateral trunk ridge ending median on the second tail ring; *S. argus* and *S. macropterygia* have the dorsal-fin origin on the ninth to thirteenth trunk ring, while the lateral trunk ridge in *S. argus* terminates on the eighth to twentieth tail ring and the twenty-fourth to thirty-fifth tail ring in *S. macropterygia*. Dawson (1982) examined specimens of *S. nigra* from New Zealand and from southern Queensland, New South Wales, Victoria, Tasmania, and Western Australia but not South Australia. He examined specimens of *S. argus* from these states and also South Australia. Photos of *S. narinosa* sp. nov. from Edithburg, South Australia, (Kuiter, 2000) were identified as *S. olivacea* (Castelnau, 1872). Examinations of images of the type of *S. olivacea* (Muséum National d'Histoire Naturelle, Paris, France, A.738) revealed a typical *S. argus*. Besides the above, no other *Stigmatopora* spp. were recognized by Dawson (1982).

Consequently, we conducted field surveys to obtain further specimens of *Stigmatopora narinosa* sp. nov.. We sampled ten specimens of *S. nigra* within the range of *S. narinosa* for meristic and morphometric comparison. In addition, we collated biological information through literature searches of all species in the *Stigmatopora* and compared their biology and ecology with that of *S. narinosa*.

Materials and methods

Specimens of *S. narinosa* sp. nov. that were examined are lodged in the South Australian Museum (SAM), Adelaide, South Australia, Australia; and in the Museum Victoria (NMV), Melbourne, Victoria, Australia. Tail ring counts and total length were recorded only for specimens with unbroken tails. Meristic values of SAM F10190 and NMV A29231 were used for brood pouch position and egg counts. The drawing in fig. 2 was taken from the paratype SAM 10186 to reduce damage through handling of the holotype.

Counts and measurements follow the methodology of Dawson (1982). Lengths were measured to the nearest 0.1 mm. Data as ratios were Arcsine transformed before testing for normality (Shapiro-Wilk W test) and homogeneity of variance (O'Brian's). Counts or transformed data were then subject to *t*-tests. All statistical analyses were performed using the JMP 5.1 software package (SAS Institute Inc., Cary, NC, USA).

The morphological abbreviations used are: DO = dorsal origin; D = dorsal ray count; P = pectoral ray count; A = anal-fin ray count; TR = trunk rings; TAR = tail rings; SDTR = sub-dorsal trunk rings; SDTAR = sub-dorsal tail rings; SDR = total sub-dorsal rings; SD = snout depth, least vertical dimension posterior of mouth; SnL = snout length, from tip of lower to posterior side of eye socket; SW = snout width, least horizontal measurement between the tip of the snout and the anterior eye socket; HL = head length, from tip of lower jaw to rear margin of operculum; TrL = trunk length, length from posterior of operculum to vent; TL = total length; STR = superior trunk ridge; STAR = superior tail ridge; ITR = inferior trunk ridge; ITAR = inferior tail ridge; LTR = lateral trunk ridge; LTAR = lateral tail ridge.



Figure 1. *S. narinosa* sp. nov. from Port Victoria, Spencer Gulf, with its prehensile tail coiled around macroalgae. The parasite is an isopod which is also commonly found on the leafy seadragon (*Phycodurus equis*). Image Graham Short.

Stigmatopora narinosa sp. nov.

Figures 2–5. Tables 1, 2.

Figured as *Stigmatopora olivacea* Castelnau, 1872: Gulf Pipefish in Kuiter (2000): 199: figs A–D. Note that female in fig. C is *S. argus*. In contradiction to the captions these images were taken at Edithburgh, South Australia (Kuiter, pers. com).

Holotype: male, SAM F10190, 150 mm TL, South Australia, Edithburg Pool, 35°05'S, 137°45'E, 31 Dec 2003. Hand netted at 10.30 am while scuba diving 30 m offshore at 2-m depth MLWS, in an open bed of mixed *Posidonia* sp. and *Zostera* sp. sea-grasses, with brown algae, on a sandy rubble substrate.

Paratypes: South Australia: SAM F10186, 135 mm TL, Edithburgh Pool, 35°05'S, 137°45'E, 29 Dec 2004. SAM F10194, 60 and 64 mm TL, Magazine Bay, Pt. Turton, 34°55'S, 137°20'E, 18 Jan 2004. SAM F10195, 72 mm TL, Port Victoria, 34°29'S, 137°28'E, 7 Jan 2004. NMV A29230-001, 143, 130, 122, 131 mm TL, Edithburg Pool, 35°05'S, 137°45'E, 22 Oct 2005. NMV A29231-001, 141, 117, 141, 128, 130 mm TL, Port Hughes Jetty, 34°04'S, 137°32'E, 30 Oct 2005.

Other material examined. SAM F 7458, 122 and 94 mm TL, Edithburgh Jetty, 35°05'S, 137° 45'E, 13 Apr 1992. SAM F 7550, 95 mm TL, Edithburgh Jetty, 35°05'S, 137°45'E, 15 Mar 1994. SAM F 7551, 73 mm TL, Edithburgh Jetty, 35°05'S, 137°45'E, 13 Apr 1992. SAM F10159, 90 mm TL, Seacliff, 35°02'S, 138°31'E, 5 Mar 2003. SAM F10160, 92 mm TL, Seacliff, 35°02'S, 138°31'E, 5 Mar 2003. SAM F10171, 114 mm TL, Port Hughes Jetty, 34°04'S, 137°32'E, 18 Mar 1994. F10186, 135 mm TL, Edithburgh Pool, 35°05'S, 137°45'E, 29 Dec 2004. SAM F10191, 74 mm TL, Port Vincent, 34°46'S, 137°52'E, 1964. SAM F10192, 70 mm TL, Seacliff, 35°02'S, 138°31'E, 5 Mar 2003. SAM F10193, 65 mm TL, Edithburgh Jetty, 35°05'S, 137°45'E, 1981. F10194, 60 and 64 mm TL, Magazine Bay, Pt. Turton, 34°55'S, 137°20'E, 18 Jan 2004. F10195, 72 mm TL, Port Victoria, 34°29'S, 137°28'E, 17 Jan 2004.

Specimens of *S. narinosa* sp. nov. (n = 7) for statistical meristic and morphometric comparison were SAM F 7458, SAM F 7550, SAM F 7551, SAM F10159, SAM F10160, SAM F10171. Comparative material of *S. nigra* (SAM F10185, n = 10) used for statistical comparison was collected at O'Sullivan's Beach Marina (35°02'S, 138°31'E). Other comparisons were with Dawson (1982).

Table 1. Meristic counts for *S. narinosa*, and *S. nigra* from South Australia.

Species / counts	Dorsal		Pectoral		SDTR		SDTAR		SDR	
<i>S. nigra</i>	36.0 ± 1.1	34–38	13.0 ± 0.0	13–13	10.57 ± 0.45	10.0–12.5	6.23 ± 0.18	4.8–7.1	16.8 ± 0.6	16.00–18.00
<i>S. narinosa</i>	40.8 ± 2.3	37–45	12.4 ± 0.5	12–13	11.75 ± 1.00	9.0–12.5	9.08 ± 0.17	8.2–9.8	19.8 ± 1.1	19.25–22.25
Probability	P<0.01		NS		NS		P<0.01		P<0.05	

P for *t*-test. NS = not significant, Dorsal = dorsal ray count; Pectoral = pectoral ray count; SDTR = sub-dorsal trunk rings ngs; SDTAR = sub-dorsal tail rings; SDR = total sub-dorsal rings. Values are expressed as means ± SD, range.

Table 2. Measurement ratios for *S. narinosa* and *S. nigra* from South Australia.

Species / ratios	SD/SnL		SW/SnL		HL/TrL		SnL/TrL		SnL/HL	
<i>S. nigra</i>	0.09 ± 0.01	0.08–0.10	0.06 ± 0.01	0.05–0.06	0.68 ± 0.13	0.59–0.76	0.43 ± 0.03	0.39–0.48	0.64 ± 0.02	0.60–0.67
<i>S. narinosa</i>	0.13 ± 0.02	0.10–0.17	0.14 ± 0.03	0.10–0.18	0.66 ± 0.05	0.58–0.68	0.38 ± 0.02	0.34–0.40	0.61 ± 0.03	0.56–0.65
Probability	P<0.01		P<0.01		NS		P<0.01		P<0.01	

SD = snout depth, least vertical dimension posteriad of mouth; SnL = snout length; SW = snout width; HL = head length; TrL = trunk length, length from posterior of operculum to vent. Values are expressed as means ± SD, range.

P for *t*-test, NS = not significant.

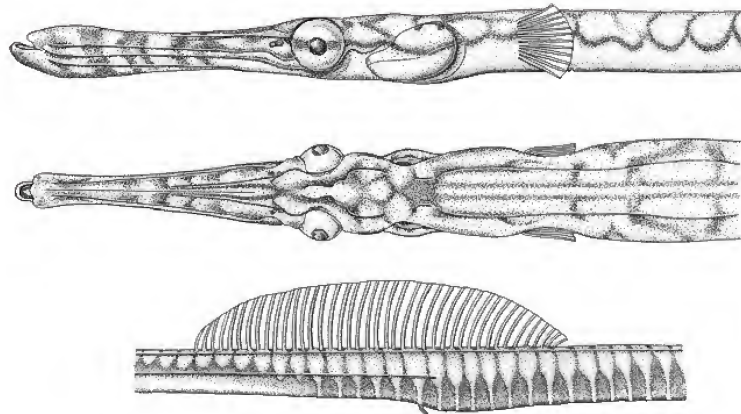


Figure 2. (a) Side view of the head, (b) dorsal view of the head, and (c) side view of the posterior trunk and anterior tail of a male *Stigmatopora narinosa* sp. nov. (Paratype SAM 10186) preserved in alcohol. The sub-dorsal ring count is $12 + 8.2 = 20.2$. The broad snout is particularly elevated near the tip. The ridges on the snout and trunk are less prominent in fresh specimens. The lateral trunk ridge ends across the second tail ring. Drawing by Lisa Waters.



Figure 3. Side view of *Stigmatopora narinosa* sp. nov. (Paratype SAM F10195). The tail tapers to a point without a caudal fin.

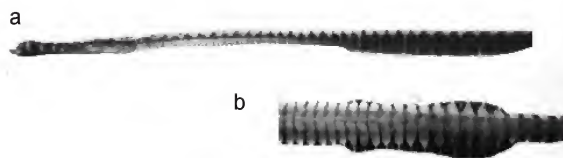


Figure 4. (a) Side view of the head, trunk and anterior of the tail of a male *Stigmatopora narinosa* sp. nov. (Holotype, SAM F10190) showing the prominent brood-pouch posterior to the vent, (b) dorsal view of the brood-pouch extending 14 tail rings from the vent, (c) ventral view of the brood pouch showing the well-developed pouch folds. This male gave birth when captured. *S. narinosa* is atypical of the genus in having up to 98 eggs in two layers, instead of 20–40 eggs in one layer.

Diagnosis. In contrast to other described species of *Stigmatopora*, trunk and tail ridges, and particularly lateral trunk ridge, indistinct in fresh specimens. Lateral trunk ridge terminates 1.5 body rings posterior to anal ring. Short, wide and slightly elevated snout. 9 sub-dorsal tail rings. Distinct banded pattern in both live and preserved specimens.

Description. STR and STAR continuous, ITR and ITAR continuous. LTR not confluent with LTAR, LTR terminating about 1.5 body rings posterior to anal ring (fig. 2). Meristic and morphometric values given in Tables 1, 2. The opercular ridge longitudinal and angled little dorsally, prominent in juveniles, reduced in adults (fig. 5). Brood pouch (fig. 4) under the anterior portion of tail, extends for 15 to 18 rings from anal ring; pouch plates absent or vestigial, brood protected by well-developed pouch folds which develop from the inferior tail ridges and touch or overlap at ventral midline within length of 1 ring.

Holotype. ♂, DO 6.5, D 40, P 13, A 4, TR 18, TAR 68, SDTR 11.5, SDTAR 7.5, SDR 19, SD/SnL 0.14, SW/SnL 0.15, HL/TrL 0.64, SnL/TrL 0.37, SnL/HL 0.62.

Colouration. Base color variably brown, red, yellow and grey-green, tending to fade to cream, brown and red in preservative. Adults mainly grey-green above with reddish-brown or dark brown markings. Red dominates toward tip of tail with the tip frequently only bright red. Pattern of dark transverse bands on each ring with the pattern changing along length of body and



Figure 5. A side (a) and dorsal (b) view of *Stigmatopora nigra* (upper; Kaup, 1853) and also of *S. argus* (lower, b,c; Richardson, 1840) from South Australia. Both species have a relatively longer more tubular snout than *S. narinosa*, with *S. argus* having a longer snout than *S. nigra*.



Figure 6. A side (a) and dorsal (b) view of *S. nigra* (upper; Kaup 1853) and also of *S. argus* (lower, b,c; Richardson 1840) from South Australia. Both species have a relatively longer more tubular snout than *S. narinosa*, with *S. argus* having a longer snout than *S. nigra*.

varying between individuals and possibly also with age. Anterior and dorsal margins of each ring dark brown or reddish brown, distinct or smudged, form a transverse band at each joint. Bands broaden ventrally, with only thin pale line remaining in middle of rings, resulting in appearance of a series of inverted saddles. Central part of bands sometimes pale resulting in double bands. Elongated spots sometimes present in these double dark bands or bands broken, further disrupting banded pattern and giving spotted or scribbled appearance. Banding often obscured, especially on the anterior half of trunk (figs 2, 4). Similar spotting sometimes under head. Juveniles often brown or golden yellow.

Reproduction. When compared to the other *Stigmatopora* spp. the most distinguishing characteristics of the reproduction of *S. narinosa* are a lack of dorso-ventral compression in females, a specialized reproductive morphology, the number and size of

the young. Sexual dimorphism characteristic of *S. nigra*, *S. argus*, and *S. macropterygia* is the dorso-ventral compression of the trunk which is exaggerated in the females during courtship. Female *S. nigra* also display bright red banding on the ventral surface during courtship.

S. narinosa has a distinctive brood pouch and potentially a greater number of brooded eggs than its congeners *S. nigra* or *S. argus*. The brood pouch is under the anterior portion of the tail and extends for 15–18 rings from the anal ring; pouch plates are absent or vestigial, and well-developed pouch folds meet on the ventral midline. The eggs of *S. narinosa* are deposited in two layers, a basal layer and then an external layer. In the specimen with the greatest recorded number of eggs there were 3 staggered rows of 64 basal membranous egg compartments on the tail, with this basal layer of eggs covered by a membrane with matching rows of egg pouches; a 2nd layer with 34 eggs within the brood pouch folds resulted in a total of 98 eggs. The total lengths of *S. narinosa* larvae at hatching are 18 mm, those of *S. nigra* 13 mm, and those of *S. argus* 32 mm. Male *S. narinosa* have extended brood patches from December to March, and juveniles < 90 mm seen from December to March. Males of *S. narinosa* can mature at 113 mm. The maximum recorded brood of *S. narinosa* of 98 eggs was far greater than that recorded by Dawson (1982) of approximately 25 for *S. nigra* and 41 for *S. argus* (IFG 2007).

Comparisons. The dorsal fin origin of *S. narinosa* is similar to that of *S. nigra* at the 5th to 7th trunk ring but contrasts with other *Stigmatopora* which have the dorsal fin origin at the 9th to 13th trunk ring. However, *S. narinosa* sp. nov. is easily distinguished from *S. nigra* in having 9, rather than 6 sub-dorsal tail rings. Other distinguishing characteristics of *S. narinosa* when compared to *S. nigra* are a greater number of dorsal rays, total sub-dorsal rings; and ratios of snout depth and snout width to snout length, lower ratios of snout length to trunk length and head length (Tables 1, 2).

S. narinosa has a distinct banded pattern in both live and dead specimens. *S. nigra* and *S. argus* also both have banding. The banding on *S. nigra* on the dorsal surface consists of dark bars between the ventral rings on the trunk and extending to the tail. Dark bands on the ventral surface of the trunk are wider than on the dorsal surface. There may be no banding on the dorsal surface of the trunk of *S. argus* or the bands may appear as narrow dark or pale bars on the trunk and anterior 3rd of the tail. *S. narinosa* has inverted saddle-like dark transverse bands on each ring, broadening ventrally, with only thin pale line remaining in middle of rings. The anterior and tip of tail of *S. narinosa* is frequently colored red to yellow with those of *S. nigra* and *S. argus* green. A further distinguishing feature of *S. argus* are dark spots or ocelli on the dorsal trunk.

S. nigra and *S. argus* have elongated narrow and shallow snouts (fig. 6). However, the snout of *S. narinosa* is short, wide and slightly elevated. The brood pouch of *S. narinosa* extends 15–18 rings from the anal ring (fig. 3). In *S. argus* the brood pouch extends 14–24 tail rings, in *S. nigra* 12–16 tail rings, and in *S. macropterygia* 21–24 tail rings.

Etymology: *S. narinosa* “naris, Latin nostril; narinus, broad-nosed” (Brown, 1954) is named after the wide and distinctive spatulate shape of its snout (fig. 2). Kuiter (2000) gives this species as *S. olivacea*, and the common name ‘Gulf Pipefish’. Because this common name is used for the North American *Syngnathus scovelli* (Evermann and Kendall, 1896), for *S. narinosa* we adopt the common name ‘Southern Gulf Pipefish’.

Distribution. *S. narinosa* is currently known only from South Australia along 200 km of inshore habitat from Seaciff (35°02'S, 138°31'E) on the southeastern coast of the Gulf St. Vincent, along the south-western shore of the Gulf St. Vincent from Pt. Vincent (34°46'S, 137°52'E) south to the Edithburgh Jetty (35°05'S, 137°45'E), and along the south-eastern shore of Spencer Gulf from Pt. Hughes Jetty (34°04'S, 137°32'E), at Pt. Victoria (34°29'S, 137°28'E), and south to Magazine Bay, Pt. Turton (34°55'S, 137°20'E) (fig. 7). Photographs appearing to be *S. narinosa* were taken at Pt. Hughes (2003) and Edithburgh Jetty (35°05'S, 137°45'E) and by Kuiter (2000) at Edithburgh (in Kuiter, 2000, image title from Cape Jarvis, Kuiter pers. com.) and Pt. Victoria (34°29'S, 137°28'E). All specimens of *S. narinosa* have been collected or photographed in sheltered shallow open water of 1–5 m depth over a substrate of a mosaic of patches of brown algae, with *Posidonia*, or *Zostera*. The only hand-netted specimen of *S. narinosa* was sampled at Stansbury (34°53'S, 137°49'E) at low tide. Deeper water trawl surveys offshore from locations inhabited by *S. narinosa* have yielded no specimens. Deeper SCUBA surveys have not found *S. narinosa*. Therefore, *S. narinosa* appears to have a very limited inshore distribution along patches of moderate energy coastlines with low turbidity and a broken vegetation pattern of sea-grass and brown algae.

The northern sections of both the Gulf St. Vincent and Spencer Gulf are low energy coastlines with typically dense *Posidonia* sea-grass beds extending from low tide mark to considerable depths. They lack an open patchy mosaic of brown algae, *Posidonia*, and *Zostera* on sand and probably do not offer suitable habitat for *S. narinosa*. Both *S. argus* and *S. nigra* generally inhabit sea-grass beds, with the larger *S. argus* (TL 254 mm; Dawson, 1982) preferring the long (~ 60 cm) and wide (~ 1 cm) *Posidonia* sp. beds, and the smaller *S. nigra* (TL 162 mm, Dawson, 1982) inhabiting the short (~ 5–14 cm) and narrow (~ 2–4 mm) *Zostera* sp. sea-grass. Both *S. argus* and *S. nigra* are colored green to grey-green. The generally reddish/brown colour of *S. narinosa* would provide better camouflage among its apparently preferred habitat of mixed sea-grass and brown algae. Seasonal water temperatures at one site inhabited by *S. narinosa* (Edithburgh Pool; 35°05'S, 137°45'E) ranged from 12–20°C.

This restricted inshore habitat of *S. narinosa* may be particularly vulnerable to pollutants or exotic marine species. On the other hand, the readily accessible inshore distribution of *S. narinosa* could facilitate the monitoring and investigation of its populations and contribute to conservation measures. The finding of a new *Stigmatopora* species in shallow inshore sites adjacent to populated areas indicates the potential for other novel species of pipefish to be discovered across southern Australia.

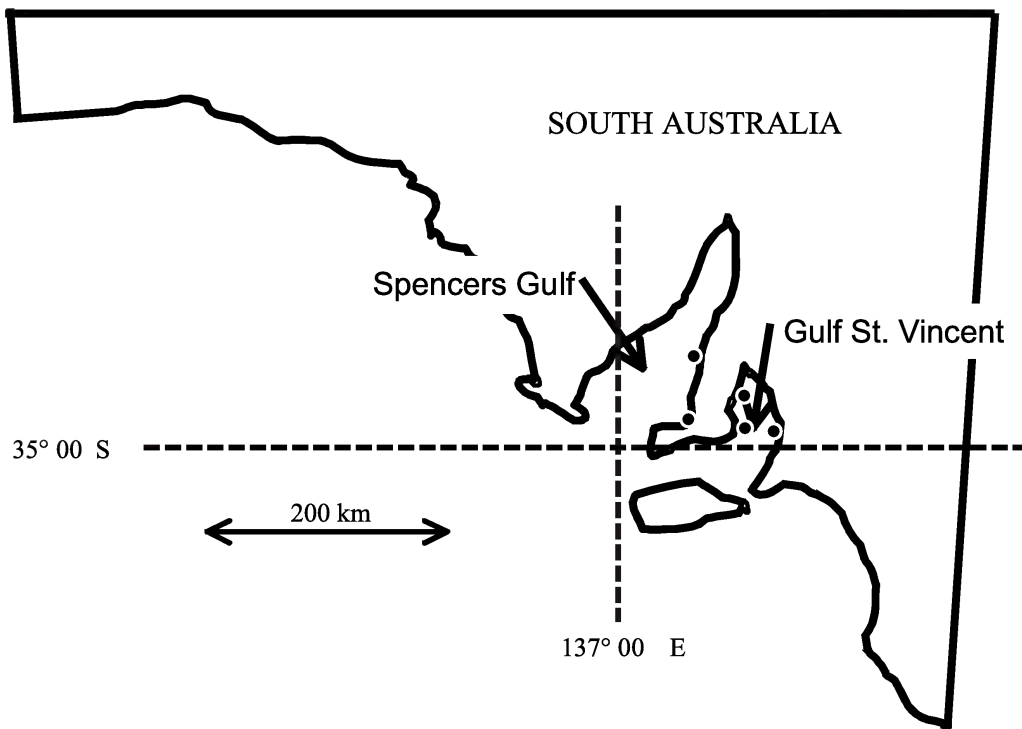


Figure 7. Known locations (•) of the Southern Gulf Pipefish *Stigmatopora narinosa* sp. nov. in South Australia. The range of *S. narinosa* extends from south-eastern Spencer Gulf, along the lower half of western Gulf St. Vincent with a localised population in eastern Gulf St. Vincent.

Acknowledgements

I thank Peter Cullen for his advice and encouragement in studying syngnathids and Lisa Waters for her preparation of Figure 2. David Muirhead and Graham Short provided information about the locations and habitats. Endorsement of this project was given by the Marine Life Society of South Australia Inc., the Scuba Divers Federation of South Australia Inc., and the Inshore Fish Group. Special thanks to Dr Martin Gomon, Museum Victoria; Dr Robert Morris for facilities and access to the South Australian Museum collections; Dr Steve Donellan, University of Adelaide, for advice about molecular phylogeny and Dr Michael Dawson, University of California at Davis, for the molecular phylogeny of the *Stigmatopora*. Michael Hammer showed me many fine points of sampling fish and some interesting gobies. Ralph Foster and Terri Bertozzi helped with the museum collection.

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Description of *Amischa paolettii* sp. nov. and *Thamiaraea tsitsilasi* sp. nov. from the Australian region (Coleoptera, Staphylinidae)

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Abstract

Pace, R. 2007. Description of *Amischa paolettii* sp. nov. and *Thamiaraea tsitsilasi* sp. nov. from the Australian region. *Memoirs of Museum Victoria* 64: 7–11

Two new species of Aleocharinae from Australia are described and illustrated: *Amischa paolettii* sp. nov. of the tribe Athetini and *Thamiaraea tsitsilasi* sp. nov. of the tribe Thamiaraeini. The genus *Amischa* Thomson is new for the Australian region.

Keywords

Coleoptera, Staphylinidae, Aleocharinae, taxonomy, Australia.

Introduction

The subfamily Aleocharinae, with over 13,000 species, is present in all zoogeographic regions of the world and most species occur in forest areas. Some species are terricolous during the day, living in soil, and in the evening become arboreal or floricolous being found on trees or on flowers. Some groups are myrmecophilous or termitophilous (Kistner, 1982) and a certain number of them live in the intertidal zones (Moore and Legner, 1976). The majority of the species in the Aleocharini are parasitoid in the larval stage of pupiparous flies (Fuldner, 1960), whereas the tribe Gyrophaenini are microphagous on fresh mushrooms (Ashe, 1984). Several species of the Hypocyptini prey on mites (Cameron, 1939). Species of *Oligota* Mannerheim, 1831, from the Australian region include *O. asperiventris* Fauvel, 1878 and *O. zealandica* Bernhauer, 1941; however, more research is needed on the Australian Hypocyptini fauna to investigate their important role in biological control of mites in various countries including the Mediterranean region (Paoletti et al., 1989).

Aleocharinae has attracted little attention from collectors and researchers. The first Aleocharinae described from Australia were *Falagria fauveli* Solsky, 1867 and *Oxypoda bisulcata* Redtenbacher, 1868 (now *Aleochara bisulcata*). McLeay (1873) described 10 more Australian species. Detailed descriptions in Latin of Aleocharinae, new and described, were given by Fauvel (1877 and 1878). Olliff (1886) published a revision of the Aleocharinae species, proposing the English translation of Fauvel's descriptions and the description of new genera and species. In 1880 and in 1895 Blackburn described three species in the genus *Aleochara*, the new genus *Barronica*, (synonym of *Leucocraspedum* Kraatz, 1859) and a new species of this genus. In 1908 Bernhauer described six new species of Australian Aleocharinae. In 1910 Lea published new

Aleocharinae species found in termite nests, ant nests and beehives, and provided a key to the species of the genus *Polylobus*, (now known as *Pseudoplandria*), ignoring Fauvel's species. In the same year he published another paper containing the description of eight new species of the genus *Calodera*. In 1920, Bernhauer described *Leptusa mjoeborgi*; however, according to my examination of the types it belongs to *Paralinoglossa mjoeborgi* (Bernhauer, 1920) comb. nov. In 1933, Oke described five new termitophilous and myrmecophilous species and genera. In 1943, Cameron described 14 new species and five more in 1950. None of these authors, except Fauvel and only in part, examined the types of the species previously described. Additionally, they did not check for the possible presence of Palaearctic genera in Australia. Recently, a taxonomic study on the species of Aleocharinae collected by the Zoological Mission of the Regional Museum of Natural Sciences in Turin financed by the National Academy of the Lincei in Rome has been published (Pace, 2003). The aim of this paper is to describe two new Australian species of this subfamily.

Methods

Species determinations were based on examination of the characters of the male copulatory organ and of the female spermatheca. Terminology follows the work of Pace (2003) and Pašnik (2001).

The genital structures were dissected and placed in Canada balsam on small transparent rectangles of plastic material, pierced on some samples. The genital structures were studied using a compound microscope and drawn with the help of a gridded eyepiece. The habitus figures were drawn with the use of a micrometre eyepiece of a binocular microscope.

The positive recognition of the genera and species is best done using illustrations of the aedeagus and/or of the spermatheca. For this reason the descriptions are brief, and limited, in order to describe traits that are graphically not reproducible, such as the colour, the reticulation and the granularity. However, for species of the subfamily Aleocharinae, a very accurate and long description does not always give an exact identification of the various species. It is the observation of the illustration of the aedeagus and/or of the spermatheca, together with that of the habitus, which helps resolve interpretative problems given by the description alone. The holotypes of the new species are deposited in Museum Victoria (MV), Melbourne, and Victoria, Australia.

Systematics

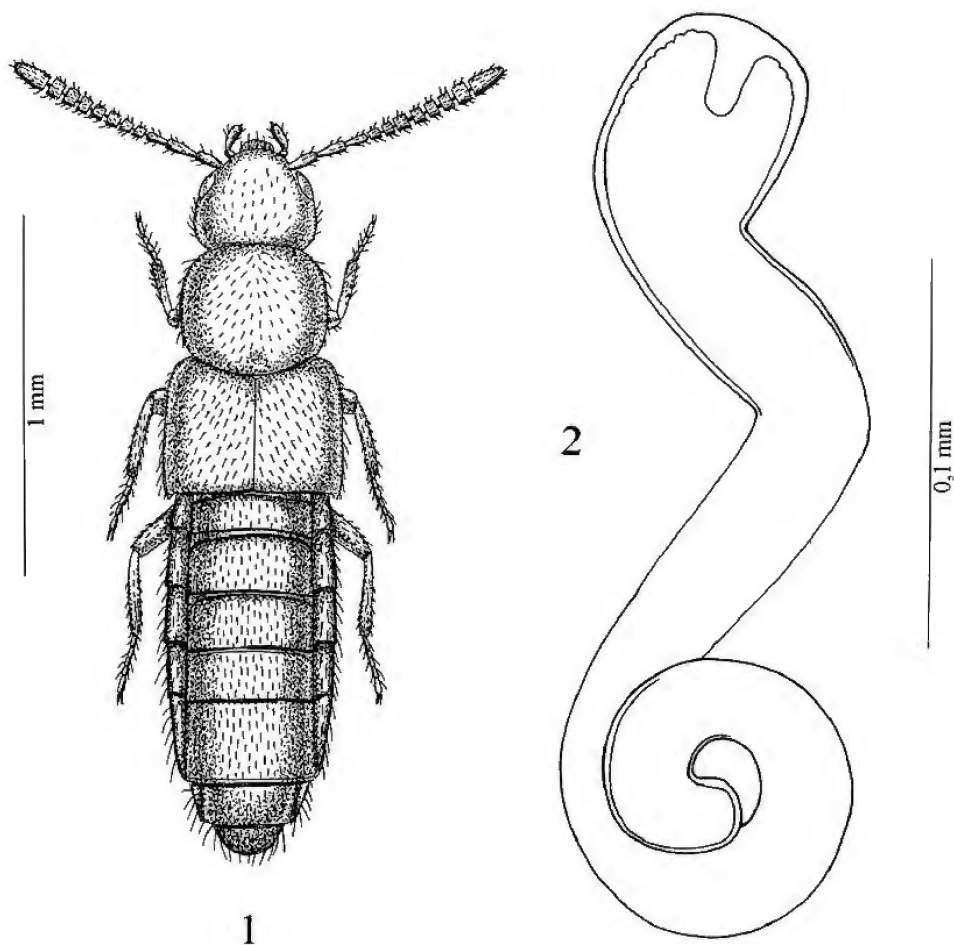
Athetini

Amischa paolettii sp. nov.

Figures 1-2

Holotype: ♀, Australia, Victoria, Gerangamete near Colac, remnant forest, 12.VIII.2004, by sweep net in pasture at forest margin, 50 m, leg. M. G. Paoletti and A. Tsitsilas (MV T-18706).

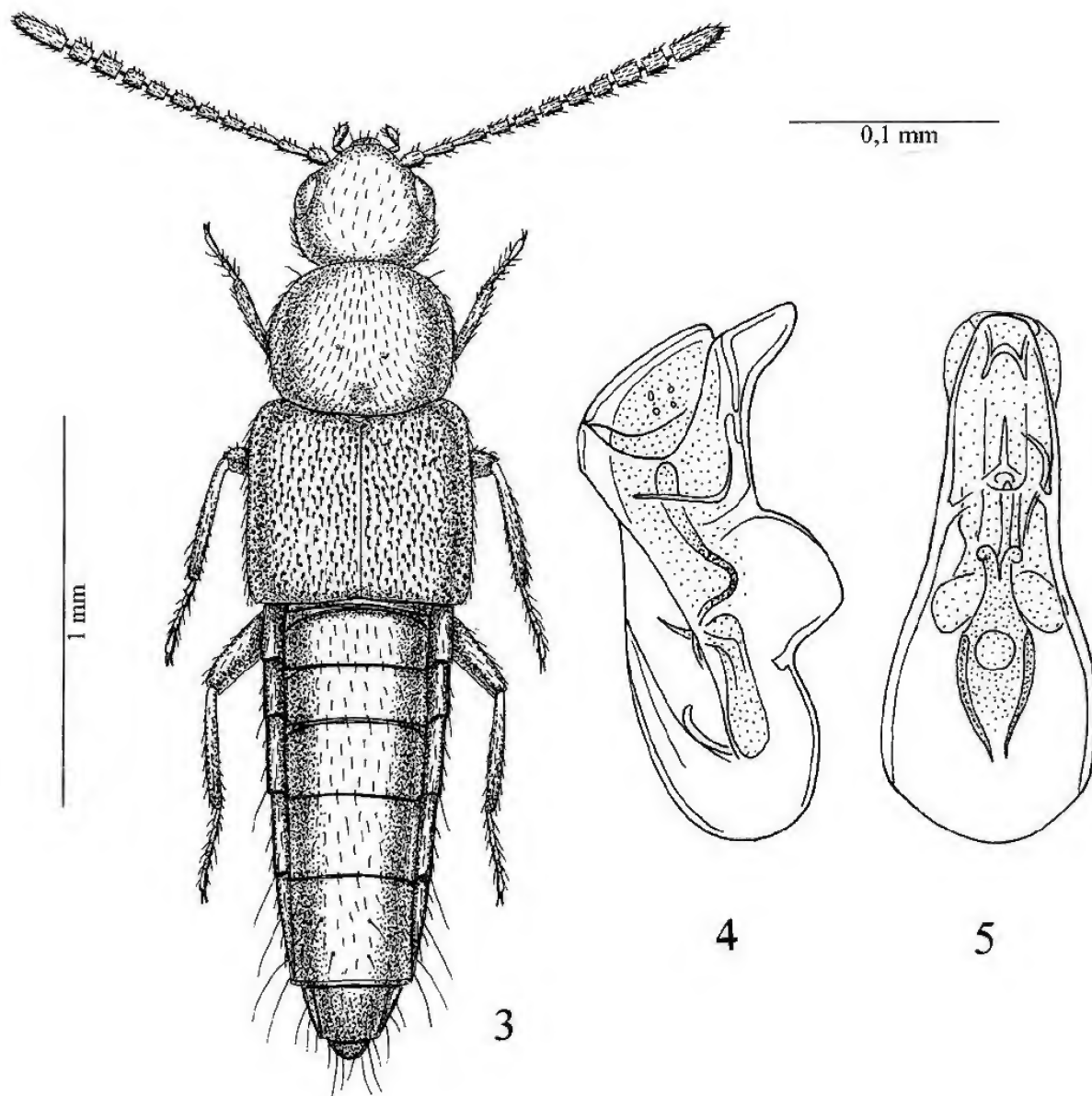
Description. Length 1.7 mm. Body shiny and brown with head and 4 basal free urites with base of the 5th urite black-brown; antennae black with 2 basal antennomeres yellow; legs yellow; 4th antennomere as long as wide; remaining antennomeres to the



Figures 1–2. Habitus and spermatheca of *Amischa paolettii* sp. nov.

10th transverse. Pronotum weakly transverse and with a weak posterior median fovea. Head and elytra reticulate; reticulate sculpture evident on pronotum, that of the abdomen superficial except evident on the 5th segment; punctuation of head not distinguishable; granularity of pronotum and of abdomen fine and superficial, on elytra also fine, but evident. Spermatheca, fig. 2.

Note. The genus *Amischa* Thomson, 1858, occurs in the Palearctic, Ethiopian and Oriental regions and this new species is the first record of the genus for the Australian region. The new species has habitus similar to that of *Amischa kashmirica* Cameron, 1939, from Kashmir. The female of the new species does not have the 6th free urotergum broadly



Figures 3–5. Habitus and aedeagus in lateral and ventral view of *Thamiaraea tsitsilasi* sp. nov.

arched as that of *kashmirica*, the spermatheca has the distal bulb reduced, despite the body being more developed in length (distal bulb very long in *kashmirica*).

Etymology. The new species is dedicated to one of its collectors, the Dr. Maurizio G. Paoletti of the University of Padua.

Thamiaraeini

Thamiaraea tsitsilasi sp. nov.

Figures 3–5

Holotype ♂, Australia, Victoria, Gerangamete near Colac, remnant forest, 12.VIII.2004, by sweep net in pasture at forest margin, 50 m, leg. M.G. Paoletti and A. Tsitsilas (MV T-18707).

Description. Length 2.3 mm. Body shiny and black-brown; antennae black, legs yellow with yellow-brown femurs, 3rd, 4th and 5th antennomeres longer than wide, 6th weakly longer than wide, 9th and 10th as long as wide, 2 superficial posterior points and an evanescent posterior median fovea on the pronotum. Abdomen scarcely narrow behind. Reticulation of the head and the pronotum evident, that of the elytra very evident and that of the abdomen superficial. Granularity of head and pronotum superficial, that of the abdomen fine, fewer closes on the posterior free urotergites. Punctuation of the elytra strong and close. Aedeagus, figs. 4–5.

Note. The genus *Thamiaraea* Thomson, 1858, occurs in the Nearctic, Palaearctic, Oriental and Australian regions. The species *T. scapularis* (Fairmaire, 1849) occurs in Sri Lanka, Hong Kong, Sulawesi, Singapore, New Guinea, Philippines, Sabah, New Caledonia, New Hebrides and Tahiti. The new species is clearly distinguished from this species by the 9th and 10th antennomeres of the new species being as long as wide but transverse in *scapularis*; the abdomen of the male of the new species is deprived of evident secondary sexual characters as is the abdomen of *scapularis*; the aedeagus of the new species is bent at the apex, in lateral view, and rectilinear in *scapularis*.

Etymology. The new species is dedicated to one of its collectors, PhD student Mr. A. Tsitsilas from the Centre of Environmental Stress and Adaptation Research (CESAR), The University of Melbourne, Melbourne, Victoria, Australia.

Acknowledgements

The specimens in the present paper were collected in Australia by Dr. Maurizio Paoletti of the University of Padua, Italy, during his sabbatical at La Trobe University in Bundoora, together with Dr. Angelos Tsitsilas, a PhD student from the Centre for Environmental Stress and Adaptation Research, the University of Melbourne, Melbourne, Victoria, Australia. I cordially thank Maurizio G. Paoletti. For the loan of types of Australian Aleocharinae I very sincerely thank Dr. Didier Drugmand of the Institut Royal des Sciences Naturelles de Belgique of Bruxelles and Dr. P.M. Hammond and Dr. M. Brendell of the Museum of Natural History in London.

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New genera and new species of the subfamily Aleocharinae from Australia (Coleoptera: Staphylinidae)

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Abstract

Pace, R. 2007. New genera and new species of the subfamily Aleocharinae from Australia (Coleoptera, Staphylinidae). *Memoirs of Museum Victoria* 64: 13–21

Two new genera and four new species of the tribe Athetini are described and illustrated: *Leptostiba paolettii* sp. nov., *Aloconota maculiventris* sp. nov., *Ischyrododyos thomsonae* gen. nov. and sp. nov., and *Notioantilogiusa rara* gen. nov. and sp. nov. The genus *Aloconota* Thomson is new for the Australian region. *Oligota pusillima* (Gravenhorst) (a possible biological control for pest mites) is reported for the first time from vineyards and shelterbelts in Victoria and Southern Australia.

Keywords

Coleoptera, Staphylinidae, Aleocharinae, taxonomy, Australia.

Introduction

The Australian fauna of the subfamily Aleocharinae is still little known. Recent scientific expeditions have led to the description of many new taxa (Pace, 1982, 1985, 2003, 2005). The wealth of species of the subfamily Aleocharinae is not only a result of the great ecological differences across Australia, but also because species of Aleocharinae tend to occupy different ecological niches with consequent evolutionary differentiation of the structures of the mouth.

Material and methods

I have examined 11 determined specimens of *Oligota asperiventris* Fauvel, 1878, in the South Australian Museum of Adelaide and specimens collected from pitfall traps at Sadliers vineyard, Glen View Road, Yarra Glen, Victoria (37°39'33"S, 145°22'21"E) by Linda J. Thomson, Zoology Department, University of Melbourne, Victoria, Australia. This method of capture of Staphylinidae in Australia explains the high percentage of new species and new genera here described.

The generic diagnoses for the Aleocharinae from Australia is essentially based on the mouthparts, particularly the ligula, and partially on the tarsal formula and the spermatheca.

The specific diagnoses are essentially based on the form of the aedeagus in lateral and ventral view and on that of the internal copulatory pieces. The spermatheca also provides reliable and stable diagnostic characters.

Given the small body size of Aleocharinae species from Australia, it is essential to mount the aedeagus, spermatheca, mouthparts and tarsi in Canada balsam for microscopic examination. Body parts prepared in Canada balsam are included on fillets of plastic laminate pierced with the same pin as the

sample to which they belong. Species determinations have been made through the comparison of the aedeagus, spermatheca and other anatomical parts, against specimens and types I have examined from the Oriental and Australian faunas.

The descriptions are limited to the main characters such as the microsculpture and the granularity that are not visible photographically. The author's conviction is that a photo or sketch, even if defective, is worth a lot more than a minute and long description for future recognition of the species.

In the present paper the median lobe of the aedeagus (deprived of the two lateral parameres that obscure the median lobe), is called, for reasons of brevity and clarity, the "aedeagus".

The holotypes of the new species are preserved in the Museum of Victoria (MV), Melbourne, Victoria, Australia.

Systematics

Hypocyphtini

Oligota pusillima (Gravenhorst, 1806)

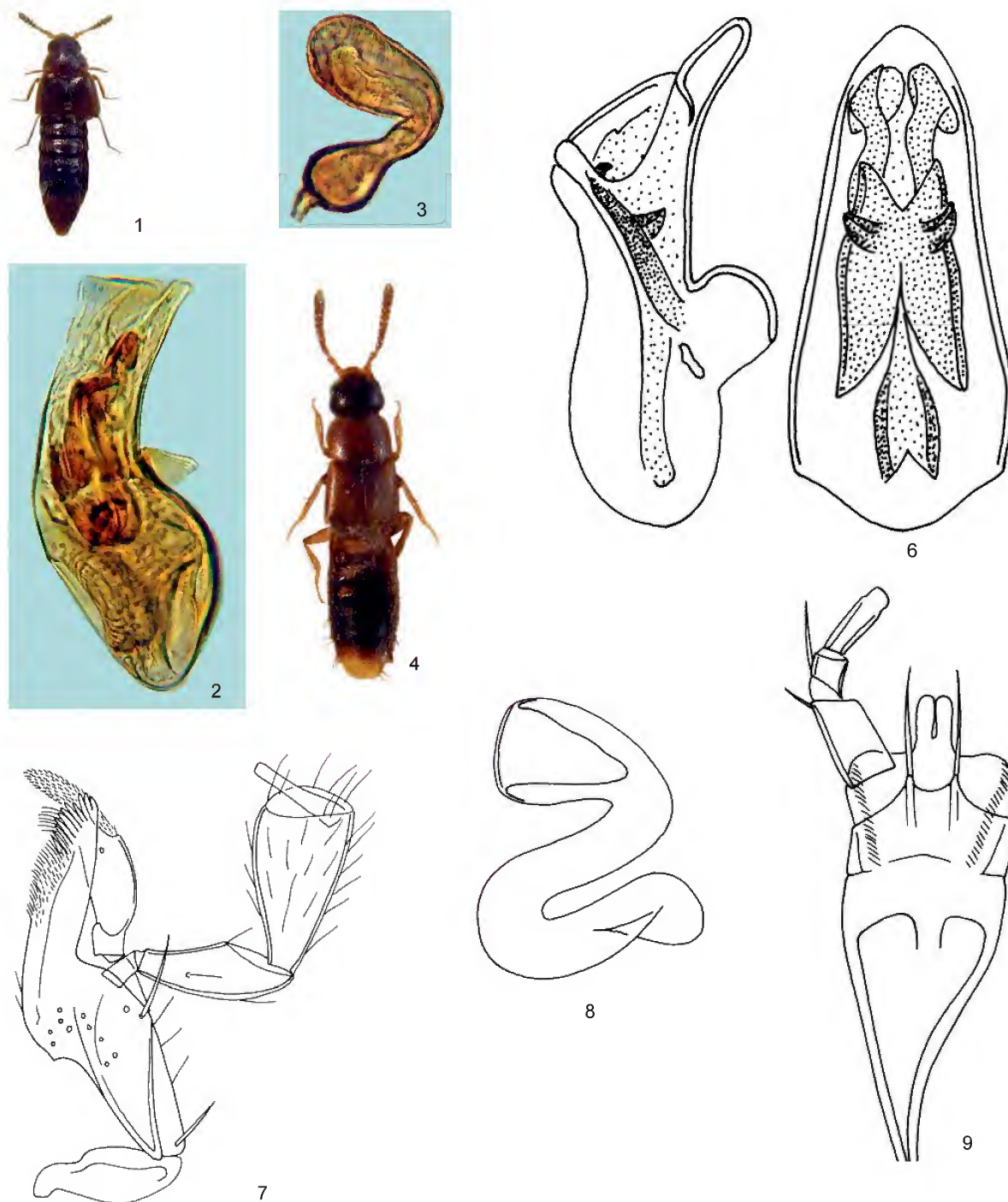
Figures 1–3

Aleochara pusillima Gravenhorst, 1806: 175

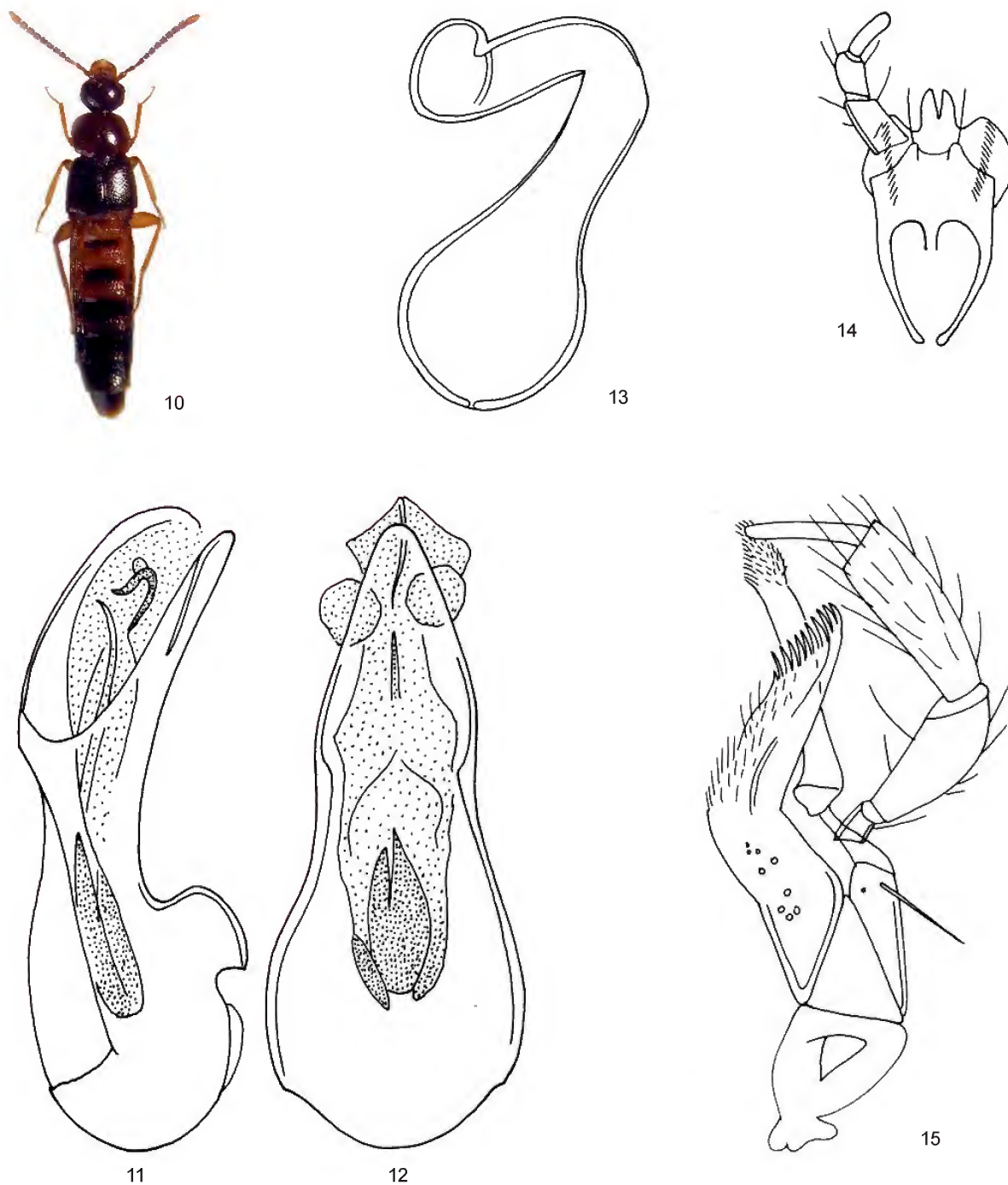
Oligota pusillima: Thomson, 1860: 262

Material examined. 3 ♂♂ and 3 ♀♀, Midwa, October 2004, Cra farms A1910, David Sharley; 1 ♂ and 2 ♀♀, Berri, S. Australia 20296, *Oligota asperiventris* ? Fvl. South Australian Museum; 2 ♂♂ and 1 ♀, Kempton, Tas.: Lea 9508, *asperiventris* ? Tas., South Australian Museum; 1 ♀, Adelaide, Blackburn, 6994 Ad., *asperiventris* Fvl., South Australian Museum; 1 ♂, Swan R., Lea, 1738, South Australian Museum.

Note. It is very probable that *O. asperiventris* Fauvel, 1878 is a junior synonym of *O. pusillima*.



Figures 1–9. Habitus, aedeagus in lateral and ventral view, spermatheca, maxilla with maxillary palpus and labium with labial palpus. 1–3: *Oligota pusillima* (Gravenhorst, 1806), specimens from Australia; 4–9: *Leptostiba paolettii* n. sp. Scale bars habitus: fig. 1 = 1.2 mm, fig. 4 = 2.1 mm. Other scale bars = 0.1 mm.



Figures 10–15. Habitus, aedeagus in lateral and ventral view, spermatheca, labium with labial palpus and maxilla with maxillary palpus. 10–15: *Aloconota maculiventris* n. sp. Scale bar habitus: fig. 10 = 2.8 mm. Other scale bars = 0.1 mm.

Distribution. Cosmopolitan species with a possible role in biological control of pest mites (M.G. Paoletti in litt.).

Athetini

Key to the Australian species of the genus *Leptostiba* Pace, 1985 in the *L. profundior* Pace, 2005 species-group

1. Body black-brown, antennae brown unicoloured, micropterous species, flightless, apical introflexion of the distal bulb of the spermatheca does not exceed the level of the basal angle of the distal bulb of the same spermatheca. Length 2.03 mm. Australia: Benlomon N.P *L. pratensis* Pace, 2005
- Bicoloured or tricolour body, antennae bicoloured, species able to fly, apical introflexion of the distal bulb of the spermatheca catch the level of the basal angle of the distal bulb of the same spermatheca 2
2. Eyes as long as the temples, elytrae dirty yellow, apex of the aedeagus narrow, ventrally viewed, proximal portion of the spermatheca clearly shorter than intermediary portion of the same spermatheca. Length 1.7 mm. Australia: Kosciusko *L. bidens* Pace, 2003
- Eyes shorter than temples, elytrae brown or yellow-brown, apex of the aedeagus wide ogival, proximal portion of the spermatheca as long as the intermediary portion of the same spermatheca 3
3. Head black-brown, 4th and 5th antennomeres longer than wide, 11th antennomere brown with apex reddish, median furrow of the pronotum, principal inside genital armour of the aedeagus long. Length 2.02 mm. Australia: Tasmania *L. profundior* Pace, 2005
- Head black, 4th and 5th antennomeres transverse, 11th antennomere unicoloured brown, median furrow of the pronotum absent, principal inside genital armour of the aedeagus short. Length 2.1 mm. Australia: Saldiers *L. paolettii* sp. nov.

Leptostiba paolettii sp. nov.

Figures 4–9

Holotype: ♂, Australia, Saldiers 33.18, pitfall trap, 17–24.11.2005, leg. L.J. Thomson (MV T-20007).

Paratype: 1 ♀, same origin but 34.19.

Description. Length 2.1–2.2 mm. Body shiny, yellow-brown, head black, 3rd free urotergite brown, 4th and 5th black with yellow-brown posterior border, antennae brown with yellow-brown basal antennomere. 2nd antennomere longer than 1st, 3rd longer than 2nd, 4th feebly transverse, 5th to 10th transverse, 11th as long as the 2 preceding antennomeres together. Eyes shorter than temples that have posteriorly widened. Reticulation of head and pronotum superficial, but evident on concave forehead. Clearly visible reticulation of the elytrae, that of the abdomen transverse and superficial. Granularity of the head close and very superficial, that of the pronotum and elytrae evident, that of the 4 free basal urotergite close and superficial

and that of the 5th free urotergite very sparse. Posterior median of the pronotum flattening. 6th free urotergite of the male plurilobate to the posterior border among 2 short lateral thorns. Aedeagus figs 5–6, spermatheca fig. 8, maxilla with maxillary palpus fig. 7, labium with labial palpus fig. 9.

Comparative notes. The deep apical introflexion of the distal bulb of the spermatheca places the new species into the Australia *L. profundior* species-group.

Etymology. The new species is dedicated to Dr. Maurizio G. Paoletti, Padua University.

Aloconota maculiventris sp. nov.

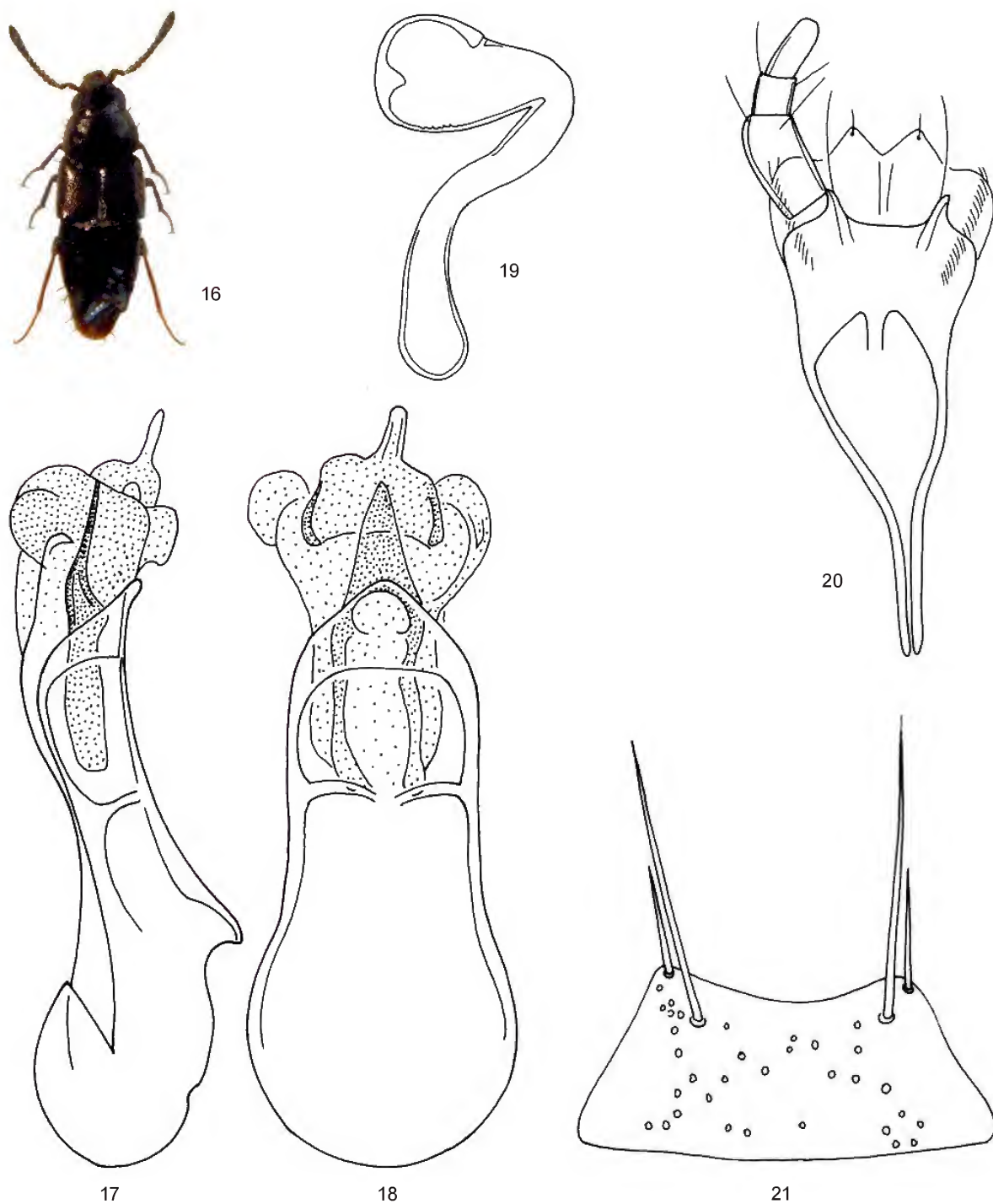
Figures 10–15

Holotype: ♂, Australia, Saldiers 185, pitfall trap, 17–24.11.2005, leg. L.J. Thomson (MV T-20008).

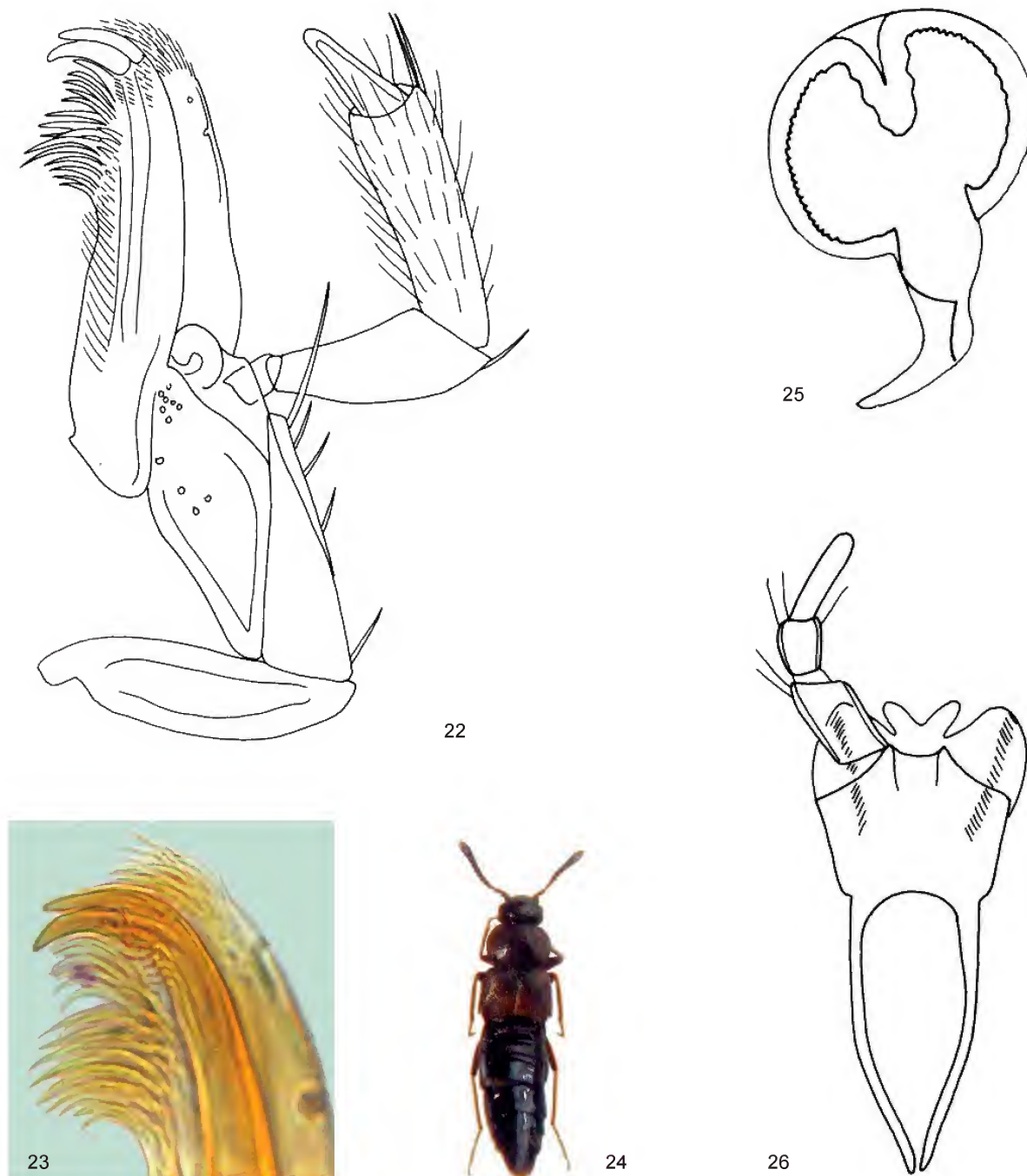
Paratypes: 4 ♀♀, Australia, Saldiers 186, pitfall trap, 17–24.11.2005, leg. L.J. Thomson; 1 ♀, Australia, Saldiers + 13, pitfall trap, 17–24.11.2005, leg. L.J. Thomson; 1 ♀, Australia, Saldiers 7.7, pitfall trap, 17–24.11.2005, leg. L.J. Thomson; 1 ♀, Australia, Saldiers n 1, pitfall trap, 17–24.11.2005, leg. L.J. Thomson; 1 ♂ and 1 ♀, Australia, Saldiers 9.6, Pitfall trap, 17–24.11.2005, leg. L.J. Thomson; 1 ♂, Australia, Saldiers: x 13, technique: pitfall trap, 17–24.11.2005, collector L.J. Thomson; 4 ♂♂ and 3 ♀♀, Australia, Saldiers: 10.6, technique: pitfall trap, 17–24.11.2005, collector L.J. Thomson.

Description. Length 2.8–2.9 mm. Body very shiny and brown, pronotum brown-reddish, basal free urotergites 1st and 2 yellow-reddish with brown-reddish median stain, pygidium yellow-brown, antennae brown with 8th to 10th antennomeres brown-reddish and 11th reddish, legs yellow. Eyes shorter than temples. 2nd antennomere shorter than 1st, 3rd a little longer than 2nd, 4th antennomeres to 7th longer than wide, the 3 following antennomeres as wide as long, 11th as long as the preceding 2 antennomeres together. Reticulation of the body absent. Punctuation of the head very superficial and missing on the longitudinal median band. Granularity of the pronotum evident and close, those of the elytrae protruding, also close. Granularity of the 2 basal free urotergites sparse and absent on the basal half, urotergites free 3rd and 4th with granules only to the posterior border, 5th free urotergite of the male with 5 salient carinae near the posterior border, the median carinae more salient than lateral ones. Aedeagus figs 11–12, spermatheca fig. 13, labium with labial palpus fig. 14, maxilla with maxillary palpus fig. 15.

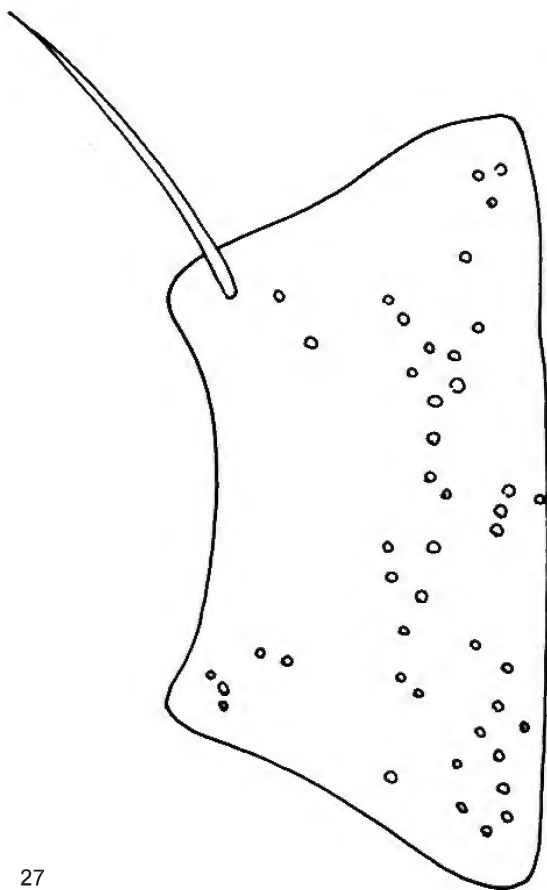
Comparative notes. This new species is the 2nd of the genus *Aloconota* Thomson for Australia after the cosmopolitan *Aloconota sulcifrons* (Stephens, 1832). The aedeagus and habitus is similar to *A. inaequalis* Cameron, 1944, from India, of which I have examined the male holotype thus labeled: Ghum Distr., Rongdong Valley, V-VI.1931, *Aloconota inaequalis* Cam., Type. The new species differs as follows: the yellow-reddish base of the abdomen is stained brown-reddish (abdomen entirely brown in *inaequalis*); the elytrae, measured from the humerus to the external posterior angle, are as long as the pronotum (much longer than the pronotum in *inaequalis*); the apex of the aedeagus is largely oval, ventrally viewed, (apex of the aedeagus blunt narrow in *inaequalis*). The female *inaequalis* is not known.



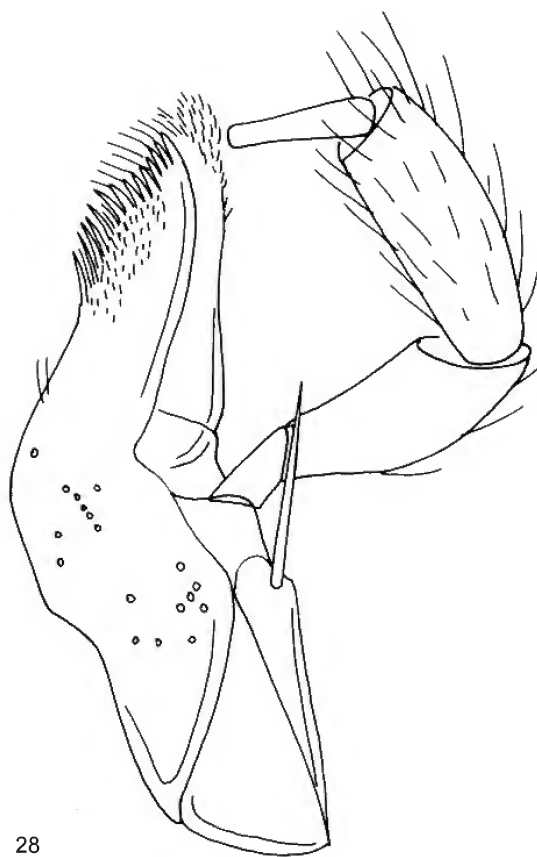
Figures 16–21. Habitus, aedeagus in lateral and ventral view, spermatheca, labium with labial palpus and mentum. 16–21: *Ischyrodyodoys thomsonae* n. sp. Scale bars habitus: fig. 16 = 1.8 mm. Other scale bars = 0.1 mm.



Figures 22–26. Maxilla with maxillary palpus, apex of the maxilla, habitus, spermatheca and labium with labial palpus. 22–23: *Ischyrodyodoys thomsonae* n. sp.; 24–26: *Notioantilogiusa rara* n. sp. Scale bar habitus: fig. 24 = 3.3 mm. Other scale bars = 0.1 mm.



27



28

Figures 27- 28. Mentum and maxilla with maxillary palpus. *Notioantilogiusa rara* n. sp. Scale bars = 0.1 mm.

Etymology. The name of the new species means “stained abdomen”.

***Ischyrodyodoys* gen. nov.**

Figures 16–23

Type species: *Ischyrodyodoys thomsonae* sp. nov.

Diagnosis. The tarsal formula 4-5-5 and the form of the mouth parts indicate that this genus belongs to the tribe Athetini. With the ligula separated in 2 lobes wide at the base, the new genus is taxonomically close to *Aloconota* Thomson, 1858, but in the new genus the lobes are much broader, fig. 20, than those of *Aloconota*, fig. 14, and have an apical bristle, absent in *Aloconota*. The lacinia of the maxilles finishes in 2 strong canine teeth, fig. 23, not as in *Aloconota*, fig. 7. The anterior border of the mentum, fig. 21, is deeply arched in the new genus. In addition, the tapered form of the body in the new genus, is clearly different from that of the species of *Aloconota*.

Description. 11 antennomeres, pronotum more narrow in front than posteriorly, abdomen very narrow posteriorly. Labial palpus 3-jointed, ligula separated in 2 lobes with wide base and with a apical bristle, fig. 20, maxillary palpi 4-jointed, maxillae with 2 strong canine apical teeth of the lacinia, galea as long as the lacinia, with pubescent apical membrane, fig. 23. Trapezoidal mentum, with smaller base deeply arched posteriorly, fig. 21. Mesosternal process insinuated between the mesocoxae, which are slightly separated. Tarsal formula 4-5-5, 1st meso-metatarsomere as long as the 2 following tarsomeres together. Aedeagus figs 17–18, spermatheca fig. 19.

Etymology. The name of the neutral grammatical genus of the new genus means “Two strong teeth” from the ancient Greek ισχυρος = strong, δύο = two and ὀδούς = tooth.

***Ischyrodyodoys thomsonae* sp. nov.**

Figures 16–23

Holotype: ♂, Australia, Sadliers 185, technique: pitfall trap, date 17–24.11.2005, collector L.J. Thomson (MV T-20013).

Paratypes: 1 ♀, same origin; 3 ♂♂ and 1 ♀, Australia, Sadliers 24.2, Pitfall trap, 17–24.11.2005, leg. L.J. Thomson; 3 ♀♀, Australia, Sadliers 34.19, Pitfall trap, 17–24.11.2005, leg. L.J. Thomson; 1 ♂ and 2 ♀♀, Australia, Sadliers 23.1, Pitfall trap, 17–24.11.2005, leg. L.J. Thomson.

Description. Length 1.8–2.0 mm. Body shiny and black-brown, antennae black with basal antennomere brown, legs yellow-brown with brown femurs and tarsi yellow. Eyes longer than temples. 1st basal antennomere longer than 2nd, 3rd as long as 2nd, 4th antennomeres to 10th transverse, 11th antennomere as long as the 2 preceding antennomeres and a half together. Reticulation of the head and the pronotum absent, that of the elytrae very superficial. Punctuation of the head thin, dense and very superficial. Granularity of the pronotum dense and salient. Naked abdomen, without granularity or reticulation, with a basal sulcus, on the 5th urotergite 2 punctures and some on each lateral side. Aedeagus figs 17–18, spermatheca fig. 19.

Etymology. The new species is dedicated to Dr Linda J. Thomson, researcher of the Zoology Department, University of

Melbourne. She collected this new species together with other new species here described.

***Notioantilogiusa* gen. nov.**

Figures 24–28

Type species: *Notioantilogiusa rara* sp. nov.

Diagnosis. Similar to *Aloconota*, but with spermatheca more similar to that of the species of the tribe Bolitocharini than to the genus *Aloconota* and the ligula is separated in 2 very divergent lobes, fig. 26, and not in 2 parallel lobes as in *Aloconota*, fig. 14.

Description. 11 antennomeres, temples divergent posteriorly, pronotum narrower in front than posteriorly, with pubescence direct to the posterior on straight line, 2 basal furrows of the abdomen; wingless genus; labial palpi 3-jointed, ligula separated in 2 very divergent lobes, fig. 26, a little leaning paraglossae in front, maxillary palpi 4-jointed, galea a little longer than lacinia, fig. 28, trapezoidal mentum with smaller base a little deeply arched posteriorly, fig. 27; mesosternal process acute, extending two-thirds of the length of the mesocoxae, tarsal formula 4-5-5, first metatarsomere as long as the 2 preceding together. Spermatheca, fig. 25.

Etymology. The female name of the new genus means “What is southern contradiction” from the ancient Greek νότιος = southern, ἀντιλογία = contradiction and οὐσα = what it is. The contradiction consists of the form of the spermatheca typical of the tribe Bolitocharini in a body with characters of the tribe Athetini.

***Notioantilogiusa rara* n. sp.**

Figures 24–28

Holotype: ♀, Australia, Sadliers 32.1, pitfall trap, date 17–24.11.2005, leg. L.J. Thomson (MV T-20012).

Paratype: 1 ♀, same origin.

Description. Length 3.3 mm. Body shiny and brown, pronotum and elytrae brown-reddish, antennae black with the 2 basal antennomeres and the apex of 11th brown-reddish, legs yellow-brown with brown femurs and yellow tarsi. 2nd antennomere shorter than 1st, 3rd as long as 2nd, 4th to 10th strongly transverse, 11th as long as the 2 preceding antennomeres and a half. Eyes as long as the temples that are densely pubescent. Reticulation of the head and the pronotum absent, that of the elytrae superficial. Punctuation of the head and the pronotum dense, superficial and missing on the longitudinal median band of the head, that of the abdomen close and missing on the basal half of every free urotergites. Granularity of the elytrae close and evanescent. 2 basal furrows of the abdomen. Spermatheca, fig. 25.

Acknowledgements

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New cucumariid species from southern Australia (Echinodermata: Holothuroidea: Dendrochirotida: Cucumariidae)

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Abstract

O'Loughlin P. M. 2007. New cucumariid species from southern Australia (Echinodermata: Holothuroidea: Dendrochirotida: Cucumariidae). *Memoirs of Museum Victoria* 64: 23–34

Four cucumariid species, new to science, are described for the rocky shallows and off-shore sediments of southern Australia: *Apsolidium falconerae*, *Neoamphicyclus altoffi*, *Neoamphicyclus materiae*, *Neocumella turnerae*. *Neocumella turnerae* sp. nov. is unique within the genus in not having table ossicles. The five syntypes of *Cucumaria mutans* Joshua are reviewed, restricted to three, and a lectotype and two paralectotypes are designated. The genus *Neoamphicyclus* Hickman is reviewed. *Cucumaria mutans* is referred to *Neoamphicyclus* Hickman. One former syntype of *Cucumaria mutans* is assigned to *Neoamphicyclus materiae* sp. nov. One former syntype of *Cucumaria mutans* has lost all ossicles and is assigned to *Neoamphicyclus* sp. A key is provided for the species of *Neoamphicyclus* Hickman.

Keywords

Echinodermata, Holothuroidea, Dendrochirotida, Cucumariidae, taxonomy, new species, key

Introduction

This paper describes new cucumariid species from the rocky shallows and off-shore sediments in the temperate waters off southern Australia. Rowe (1995) summarized our knowledge of cucumariid species occurring in Australia. A small group of species was described from tropical waters with distributions extending to the temperate southern waters of Australia: *Plesiocolochirus spinosus* (Quoy and Gaimard, 1833); *Colochirus quadrangularis* Troschel, 1846; *Cercodemas anceps* (Selenka, 1867); *Mensamaria intercedens* (Lampert, 1885); and *Plesiocolochirus dispar* (Lampert, 1889). Most of the southern Australian cucumariid species occur in temperate waters only. *Plesiocolochirus ignavus* (Ludwig, 1875) was described from South Australia, *Staurothyone inconspicua* (Bell, 1887) and *Cucumella mutans* (Joshua, 1914) from Victoria, *Staurothyone vercoi* (Joshua and Creed, 1915) from South Australia, and *Amphicyclus mortenseni* Heding and Panning, 1954 and *Neoamphicyclus lividus* Hickman, 1962 from Tasmania. O'Loughlin and O'Hara (1992) added 12 new cucumariid species for southern Australia: *Apsolidium alvei*; *A. densum*; *A. handrecki*; *Cucuvitrum rowei*; *Neocnus bimarsupii*; *Neocumella fracta*; *Neocumulus cauda*; *Pentocnus bursatus*; *Ocnus occiduus*; *Squamocnus aureoruber*; *Trachythyone candida*; *Trachythyone glebosa*. O'Loughlin and Alcock (2000) re-assigned *Ocnus occiduus* to their new genus *Australocnus*. O'Loughlin (2000) added the new species *Psolidiella hickmani* from south-eastern Australia and *Psolidiella maculosa* from south-western Australia, and reported the New Zealand species *Psolidiella nigra* Mortensen,

1925 from the eastern coast of southern Australia. Two new species have been distinguished here from the closely related ones *Cucumella mutans* (Joshua) and *Neoamphicyclus lividus* Hickman, and an associated generic revision has been undertaken. Two other new species are added from recently examined material.

Materials and methods

The material examined here is principally in the collections of Museum Victoria. Some specimens were borrowed from the Tasmanian and Western Australian Museums. Photography of live specimens and the preserved types was done by Leon Altoff and Audrey Falconer. Photos of ossicles and body wall mounts were taken by Mark O'Loughlin and Chris Rowley using an Olympus BX50 compound microscope and Nikon D70 digital camera, and a Leica DM5000 B compound microscope and Leica DC500 camera with montage software.

Abbreviations: NMV, Museum Victoria, registration number prefix F; TM, Tasmania Museum and Art Gallery, prefix H; WAM, Western Australian Museum, prefix Z. Throughout this paper Rowe (in Rowe and Gates, 1995) is referred to as Rowe (1995), Dr. Frank W.E. Rowe being the systematic authority in that work.

Dendrochirotida Grube, 1840 (restricted by Pawson and Fell, 1965)

Cucumariidae Ludwig, 1894 (emended Pawson and Fell, 1965)

Subfamily **Colochirinae** Panning, 1949

Apsolidium O'Loughlin and O'Hara 1992

Type species. *Apsolidium handrecki* O'Loughlin and O'Hara, 1992 (original designation).

Other species. *Apsolidium alvei* O'Loughlin and O'Hara, 1992; *A. densum* O'Loughlin and O'Hara, 1992; *A. falconerae* sp. nov.

Diagnosis. See O'Loughlin and O'Hara (1992).

Distribution. Southern Australia: from Victoria (Western Port) to SW Western Australia (Trigg I.); not reported from Tasmania; 0–10 m.

Apsolidium falconerae sp. nov.

Figures 1a, 2a, 3a–d, 4a

Material examined. Holotype: Australia, Victoria, Western Port, Phillip I., Cat Bay, shallow sublittoral, covered with detrital material (held by tube feet), attached to undersurface of rock, C. Handreck, 7 Mar 1995, NMV F109375.

Description. Body length 34 mm, maximum width 15 mm (preserved; tentacles excluded, partly withdrawn); body rounded dorsally, flat ventral sole, tapering from wide high oral end to lower narrow anal end; wide dorso-anterior oral end; short dorso-posterior rounded blunt anal cone; dorsal and lateral body wall thin, densely calcareous, rough, small irregularly distributed scales evident, not overlapping; ventral body wall distinctly thin semi-translucent sole with ossicles evident, irregularly oval, tapering posteriorly, rounded not acute junction with ventro-lateral body wall, peripheral series of tube feet; 9 dendritic tentacles, 8 large, 1 small ventral; radial and interradial calcareous ring plates wide posteriorly with central deep notch, radially tapering anteriorly to blunt columnar projection, interradially to thick point, heights of plates subequal; small tube feet scattered closely over dorsal and lateral surfaces; large tube feet ventrally, continuous peripheral irregular series 5-wide, mid-ventral radial series 2–4 wide; single dorsal madreporite near vascular ring, irregular short-branched form, less than 1 mm long; single ventral polian vesicle; gonad tubules unbranched; longer respiratory tree branch extends half coelom length; longitudinal muscles thin, flat, retractor muscles branch off in mid-body.

Ossicles. Dorsal and lateral body wall and tube feet with multilayered ossicles (small scales), buttons, cups, tube foot endplates, tube foot perforated support plates; multilayered ossicles up to 896 μm long; buttons irregular, thick, knobbed, perforated, 104–192 μm long, most small, some with secondary layer developments, some intergrading with multilayered ossicles; complex bluntly spinous cups, basal cross, branching from rim to close over cup to varying extents, 112–144 μm long; small endplates, up to 184 μm diameter, smallest perforations centrally; tube foot support plates irregularly oval, perforated, denticulate on 1 margin, sometimes curved, typically 160 μm long. Ventral tube feet with endplates, support plates, narrow plates: endplates up to 280 μm diameter, small perforations centrally, large peripherally; support plates

elongate, bent or curved, perforated, denticulate on 1 margin, typically 256 μm long. Sole with plates and cups: plates perforated, thick, knobbed, single-layered, variably oval to narrowly elongate, up to 400 μm long; cups rare, 80 μm long, thin-walled, shallow, denticulate margin, denticulations slightly globose. Tentacles with rods, narrow plates, small plates, lacking rosettes: rods thick, straight or curved, large lateral perforations, small terminal perforations, up to 296 μm long (intergrade with narrow plates); narrow plates bent or curved, thick, few central and distal perforations, margin thickly denticulate, up to 200 μm long; small plates tentacle dendritic branch endplates, thin-walled, perforated, irregularly oval, cupped or curved, marginally finely denticulate, typically 56 μm long.

Colour. Live: body white dorsally and ventrally; tentacle dendritic branches yellow (pers. comm. Clarrie Handreck). Preserved: body and tentacle dendritic branches white; tentacle trunks and oral disc with dark brown flecking.

Distribution. Victoria, Western Port, Phillip I., Cat Bay; 0–1 m.

Etymology. Named for Audrey Falconer (Marine Research Group of Victoria), in appreciation of her dedication to marine invertebrate studies on the coast of Victoria, and especially for her contribution to photography in this work.

Remarks. The genus *Apsolidium* O'Loughlin and O'Hara, 1992 was described for 3 southern Australian species: *A. alvei*, *A. densum*, *A. handrecki*. *Apsolidium falconerae* sp. nov. shares the distinctive diagnostic characters of the genus. The body form and cup ossicle form distinguish *A. falconerae* from the other 3 species. None of the other 3 species has a body form that tapers distinctly from anterior to posterior, or has dorsal and lateral body wall cups with an extensively developed rim that creates variably closed cups. *A. falconerae* also lacks the tentacle rosette ossicles of each of the other 3 species. It is assumed here that the single small ventral tentacle of *A. falconerae* is exceptional and would normally be a pair.

Subfamily **Thyonidiinae** Heding and Panning, 1954

Neoamphicyclus Hickman, 1962

Neoamphicyclus Hickman, 1962: 58.—Rowe, 1995: 275.

Diagnosis (emended). Dendrochirotid holothuroid genus, up to 60 mm long with maximum diameter 25 mm (preserved; tentacles excluded); sub-cylindrical form, elongate, narrowing anteriorly, tapering posteriorly to a narrowly rounded anal cone; 25 dendritic tentacles, irregularly grouped outer ring of 15 large, 5 irregularly grouped inner pairs small, total number and sizes variable, groups not aligned with radii; lacking collar of papillae around tentacle ring; tube feet on radii only, in 5 paired single series, paired zig-zag to double series in mid-body; radial tube feet present or absent across true introvert; calcareous ring not composite, lacks posterior prolongations; radial plates sub-rectangular, variable form in same specimen, commonly asymmetrical anteriorly, deep notch above muscle

attachment, lateral shallow indentation, deep posterior notch, posterior projections not upturned; interradiial plates almost as tall as radial plates, posteriorly wide with shallow indentation, tapering to point anteriorly; single dorsal stone canal and madreporite near vascular ring, rarely 2 or 3, small, madreporite with "split pea" form, less than 1 mm diameter; 1–3 ventral tubular polian vesicles; longitudinal muscles flat, undivided, retractor muscles branch from mid-body; tufts of gonad tubules on both sides of dorsal mesentery; respiratory trees extend coelom length.

Ossicles. Body wall and introvert with table disc ossicles only, with or without spires, sparse to numerous, predominantly irregular in form, pillars 2–5, predominantly 3. Tube feet with endplates, each with narrow rim of elongate perforated support plates, typically 2 large central perforations. Tentacles with irregular rods; variably with or lacking rosettes and tables. Posterior anal body wall with 5 rudimentary scale ossicles.

Type species. *Neoamphicyclus lividus* Hickman, 1962 (original designation).

Other species. *N. altoffi* sp. nov.; *N. materiae* sp. nov.; *N. mutans* (Joshua, 1914).

Distribution. Southern Australia: New South Wales (south of Bateman's Bay), Tasmania, Victoria, South Australia, Western Australia (south of Abrolhos Is.); 0–165 m.

Remarks. In describing his species and diagnosing his monotypic genus Hickman (1962) accurately observed that the table discs always lacked spires. This has been confirmed here by extensive sampling of specimens of *Neoamphicyclus lividus* from SE Tasmania. Specimens of a superficially similar species from N Tasmania, Victoria, South Australia and Western Australia have been determined in the past as *N. lividus*. However, in all of the many specimens sampled in this work most of the otherwise similar table discs have spires. Rowe (1982) and Marsh (1991) noted these spires. This has led to the recognition of a second allopatric *Neoamphicyclus* species (*N. materiae* sp. nov. below). *Cucumaria mutans* Joshua, 1914 was reassigned to *Cucumella* Ludwig and Heding, 1935 by Heding and Panning, 1954, partly on the basis of having 20 tentacles. The syntypes and many specimens of *C. mutans* available for this study have 25 tentacles. *C. mutans* has all of the emended diagnostic characters of *Neoamphicyclus* Hickman, 1962 to which it is reassigned below. In fact one of the syntypes of *C. mutans* is *Neoamphicyclus materiae* sp. nov. (discussed below). Some specimens from across southern Australia, previously identified as *Cucumella mutans*, are recognized in this work as a 4th *Neoamphicyclus* species (*N. altoffi* sp. nov., below). In the 4 species of *Neoamphicyclus* both the "true" introvert and part of the anterior body ("pseudo" introvert) may be withdrawn by the retractor muscles. This distinction between true and pseudo introvert is made in the descriptions. Radial tube feet are present on the pseudo introvert in all *Neoamphicyclus* species, but may be present or absent on the true introvert in the various species. The 165 m depth in the distribution range is taken from H.L. Clark (1946), but the specimen is not confirmed here as *N. mutans* (Joshua, 1914) or *N. altoffi* sp. nov. (below) or *N. materiae* sp. nov. (below).

Key to the species of *Neoamphicyclus* Hickman, 1962

1. Body wall ossicles table discs, with or lacking spires, sparsely present in body wall, small, rarely up to 64 μ m wide in specimens more than 15 mm long; tentacles lacking rosette ossicles 2
 - Body wall ossicles table discs with spires, numerous in body wall, large, most more than 64 μ m wide in specimens more than 15 mm long; tentacles with rosette ossicles 3
2. All table discs lacking spires *Neoamphicyclus lividus* Hickman, 1962
 - Most table discs with spires *Neoamphicyclus materiae* sp. nov.
3. Middle and upper tentacle trunks with white lumps, rosette ossicles numerous; lacking white band across the inner (oral) tentacle base; table discs mostly irregular; table discs frequently up to 96 μ m wide *Neoamphicyclus mutans* (Joshua, 1914)
 - Middle and upper tentacle trunks lacking white lumps, ossicles irregular rods only; white band across the inner (oral) tentacle base, rosette ossicles numerous; table discs frequently regular with 3 large, 3 small perforations, 3 pillars; table discs frequently 80 μ m wide *Neoamphicyclus altoffi* sp. nov.

Neoamphicyclus altoffi sp. nov.

Figures 1c, 1d, 2c, 4b, 4c

Cucumella mutans Hickman, 1962: 55–56, text figs 38–45, pl. 1 fig. 4 (non *Cucumella mutans* (Joshua, 1914)).

Material examined. Holotype: Western Australia, Fremantle, Hall Bank, C. Bryce, L. Marsh, S. Slack-Smith, 25 Jan 1980, WAM Z279-92.

Paratypes: Cockburn Sound, Woodman's Point, *Posidonia* bed, 1 m, N. Sammy, 25 Aug 1971, WAM Z722-71 (2); B.R. Wilson, 11 Feb 1968, WAM Z721-71 (1); Cockburn Sound, south flats, A. Jones, 24 Nov 1966, WAM Z453-78 (1); Garden I., Careening Bay, Skippy Rock, 3–7 m, R. Slack-Smith, 6 Jan 1965, WAM Z729-71 (1).

Other material. Victoria, East Gippsland Scallop Survey, 38°12.3'S, 147°33'E, 26 m, 27 Feb 1971, NMV F76470 (1); Bass Strait Survey, VIMS 81-T-1, BSS stn 178, 38°43.4'S, 146°56.9'E, 26 m, 18 Nov 1981, F76623 (1); BSS stn 188, 38°38.2'S, 142°35'E, 59 m, 20 Nov 1981, F76622 (1). Tasmania, Derwent Estuary, dredged off Sandy Bay, 9–12 m, 23 Sep 1955, TM H2139 (2); Waterhouse Passage, Blizzards Landing, 26 Feb 1991, F132717 (2); Tamar R., Green's Beach, 3 May 1986, F58459 (1). South Australia, Kangaroo I., Emu Bay, rocky shallows, algal epifauna, 17 Jan 1990, F132699 (1); Investigator Group, Topgallant I., 25 m, 21 Apr 1985, F132713 (1). Western Australia, Albany, Princess Royal Harbour, 4–13 m, 22 Jan 1988, F132704 (1); 4 m, 22 Jan 1988, F132724 (1); Geographe Bay, Forrest Beach, seagrass bed, 1 Jan 1972, WAM Z201-73 (2); Dunsborough, under stones, 0.2 m, 31 Jan 1972, WAM Z209-73 (1); SW of Bunbury, FRV *Lancelin*, 20 m, 13 Apr 1963, WAM Z764-71 (2).

Description. *Neoamphicyclus* species up to 46 mm long with maximum diameter 10 mm (preserved; tentacles excluded); perioral thin conical pointed papillae, about 0.2 mm long; radial tube feet do not cross true introvert, a few sometimes encroach onto true introvert; gonad tubules branched.

Ossicles. Body wall, introvert, with abundant table ossicles only: table discs regular and irregular in form, frequently 80 μm wide and regular with 3 large, 3 smaller perforations, 3 pillars; discs size range 40–88 μm wide, perforations 3–12, spires typically with 3 pillars, infrequently 2–5, spires 32–40 μm long; in small 6 and 13 mm-long specimens maximum table disc width was 56 μm , indicating an increase in table disc size with increase in specimen size. Tube feet with endplates up to 320 μm diameter; few elongate-perforated support plates, about 184 μm long, frequently 2 large perforations centrally. Tentacle trunks above base with irregular rods only, 64–328 μm long, small perforations distally, some short-branching, rare blunt spines. Tentacle trunk base with rosettes and tables, some intergrading: anastomosing rosettes, frequently closed peripherally, largest with central perforations with small tripod, rosettes up to 104 μm long; tables irregular, up to 80 μm long, 2–3 pillars, some with up to 15 small perforations. Oral disc and papillae with rosettes and thin rods, some intergrading: anastomosing rosettes, frequently closed peripherally, irregularly oval, up to 64 μm long; rods thin, rare lateral branching, distally few to many small perforations, up to 224 μm long. Posterior anal body wall with 5 rudimentary scales (anastomosing calcareous bodies), irregular form, up to 280 μm long.

Colour (preserved). Body and tube feet dark blue-grey to dark grey-brown to brown to pale brown to off-white; introvert brown to off-white; tentacle dendritic branches dark brown, upper trunks pale grey/translucent, lacking white patches, inner base of tentacle trunks with transverse white band; oral disc dark brown, with white patches.

Distribution. Victoria (East Gippsland), Bass Strait, SE and N Tasmania, South Australia, SW Western Australia (Perth); 0–59 m.

Etymology. Named for Leon Altoff (Marine Research Group of Victoria), in appreciation of his dedication to marine invertebrate studies on the coast of Victoria, and especially for his contribution to photography in this work.

Remarks. Most of the specimens referred hereto *Neoamphicyclus altoffi* sp. nov. have been previously determined as *Cucumella mutans* (Joshua, 1914). Hickman (1962) reported *Cucumella mutans* from SE Tasmania (Derwent estuary; TM H2139). Two specimens were re-examined here and determined as *N. altoffi* sp. nov. Marsh and Pawson (1993) determined “with some doubt” as *Cucumella mutans* (Joshua, 1914) a small specimen (7 mm long), lacking tentacles, from 30 m at Rottnest I. (SW Australia). The form of the body wall tables is illustrated, and closely resembles those of *N. altoffi*, as does the average disc diameter for a small specimen (49 μm). But tables with curved discs from tube feet are illustrated, and these have not been found here in *N. altoffi* or *C. mutans*. *N. altoffi* has not been found in the shallows of the coast of Victoria. It has been found in the shallows from NE Tasmania to near Perth in Western Australia. *N. altoffi* is distinguished from the other 3 species of *Neoamphicyclus* in the key.

Neoamphicyclus lividus Hickman, 1962

Figure 2f

Neoamphicyclus lividus Hickman, 1962: 58, text figs 53–63, pl. 1 fig. 5.—Hickman, 1978: 29–31, figs 1–14.—Dartnall, 1980: 54, map 16.—Rowe, 1982: 460, 468–469, fig. 10.34b (part).—Rowe and Vail, 1982: 222.—Materia et al., 1991: 301, 306–307 (part; SE Tasmania specimens).—O'Loughlin, 1991: 226, table 1 (part; SE Tasmania specimens).—O'Loughlin and O'Hara, 1992: 227–28, Table 1.—O'Loughlin, 1994: Table 1 (part; SE Tasmania specimens).—Rowe, 1995: 275 (part; SE Tasmania and King I. specimens), (part *Neoamphicyclus materiae* sp. nov. below; non *N. lividus* Hickman, 1962).

Type locality. SE Tasmania, Pirates Bay, Eaglehawk Neck, rocky shallows.

Material examined. SE Tasmania, Bruny I., Adventure Bay, rocky shallows, 11 Jan 1989, NMV F58700 (30); Opossum Bay, rocky shallows, 15 Nov 1982, F58698 (18+7 juveniles); F58707 (1, 5 brood juveniles); Frederick Henry Bay, Carlton Point, Red Ochre Beach, 23 Nov 1968, F132714 (3); Eaglehawk Neck, rocky shallows, 15 Feb 1991, F132711 (33); N Tasmania, King I., Gulchway, S of Surprise Bay, rocky shallows, 10 Mar 1980, F58697 (2); F58699 (5).

Description. *Neoamphicyclus* species up to 35 mm long with maximum diameter 14 mm (preserved; tentacles excluded); perioral papillae digitiform to distally sub-globular, about 0.2 mm long; radial tube feet cross true introvert; gonad tubules with single branch, extend coelom length.

Ossicles. Body wall, introvert, with table disc ossicles only: discs never with spires, irregular in form, table discs decrease in number and size with increase in specimen size; in 6-mm long specimen discs abundant, 40–104 μm wide, 3–13 perforations; in 10 mm-long specimen discs 32–72 μm wide, 3–20 perforations; in 30 mm-long specimen discs sparse, 36–48 μm wide 2–6 perforations. Tube feet with endplates up to 200 μm diameter; few elongate perforated support plates, up to 112 μm long. Tentacles with irregular rods only, perforations distally, lacking rosettes, rods up to 112 μm long. Oral disc with rods only, lacking rosettes. Posterior anal body wall with 5 rudimentary scales (anastomosing calcareous bodies), irregular form, up to 320 μm long.

Reproduction. Sexes separate; coelomic brood protection by females (Hickman, 1978; Materia et al., 1991).

Colour (preserved). Body blue-grey, slate-grey, grey-black, dark grey-brown, dark brown, brown, frequently dark anteriorly and posteriorly; tentacles darker in colour, lacking white patches.

Distribution. SE Tasmania; N Tasmania, King I.; rocky shallows.

Remarks. There are ossicle changes with change in specimen size. In a 10-mm long specimen of *N. lividus* (F132711), the disc plates have 2 forms: typical discs 32–72 μm wide 3–20 perforations; atypical thick perforated plates 96–112 μm wide 9–23 perforations. These perforated plates are not evident in larger specimens. Hickman (1978) illustrated significantly larger table discs with more perforations in coelomic juveniles than larger specimens.

Hickman (1978) and Materia et al. (1991) reported coelomic brood-protection by *N. lividus*. Only *N. lividus* specimens collected in summer months between 15 November and 19 March were reported, with few, large brood juveniles. For *Neoamphicyclus materiae* sp. nov. (below) brood release is principally in October, with a few larger brood juveniles found in females in December. A pattern of seasonal brood protection with most brood juveniles released in spring appears to be the same for *N. lividus* and *N. materiae*. Materia et al. (1991) noted the relatively larger full size of *N. lividus* specimens from SE Tasmania compared with specimens from SE mainland Australia (now *N. materiae* sp. nov. below). *N. lividus* is distinguished from the other 3 species of *Neoamphicyclus* in the key.

***Neoamphicyclus materiae* sp. nov.**

Figures 1e, 2e, 4d

Cucumaria mutans Joshua, 1914: 4, pl. 1 figs 1a–d (part).—Joshua and Creed, 1915: 18 (part).—H.L. Clark, 1938: 444–445 (part) (part non *Cucumaria mutans* Joshua, 1914).

Mensamaria thomsoni.—H.L. Clark, 1946: 406 (part, juvenile forms, non *Mensamaria thomsoni* (Hutton, 1879)).

Neoamphicyclus lividus.—Hickman, 1962: 58 (East Devonport).—Rowe, 1982: 460, 468–469, fig. 10.34b (part).—O’Loughlin, 1984: 151.—Materia et al., 1991: 301, 305–307, tables 4, 5, figs 4, 5 (part; Victoria specimens).—O’Loughlin, 1991: 226, table 1 (part; Victoria specimens).—O’Loughlin and O’Hara, 1992: 227–228, table 1 (part).—O’Loughlin, 1994: table 1 (part; Victoria specimens).—Rowe, 1995: 275 (N Tasmania, except King I., and southern Australia) (non *Neoamphicyclus lividus* Hickman, 1962).

cf. *Neoamphicyclus lividus* Hickman.—Marsh, 1991: 472–473 (non *Neoamphicyclus lividus* Hickman, 1962).

Material examined. Holotype: Victoria, Flinders ocean platforms, E of Mushroom Reef, shallow sub-littoral, under rocks and on algae, T. Megens, M. O’Loughlin, 10 Mar 1980, NMV F132722.

Paratypes: Type locality and date, F76372 (4); SE corner of Mushroom Reef, M. O’Loughlin, 12 Dec 1985, F76360 (11); E of Mushroom Reef, C. Materia, M. O’Loughlin, 9 Oct 1987, F76364 (14).

Other material. New South Wales, 12 km S of Bateman’s Bay, Pretty Point Bay, 11 Aug 1991, F132707 (2). Victoria, syntype of *Cucumaria mutans* Joshua, 1914, F132702 (1; ex F45139, non *C. mutans*); Mallacoota, 21 Jan 1981, F76422 (4); Shack Bay, VNPMS stn 27, rocky subtidal, 4–6 m, 14 Feb 1996, F146573 (1); Cape Paterson, VNPMS stn 2, rocky subtidal, 2 May 1995, F146572 (1); Phillip I., Kitty Miller Bay, 25 Oct 1987, F58590 (17); S of Apollo Bay, Marengo, Hayley Point, 11 Jan 1980, F58720 (7); Killarney, 20 Apr 1983, F76461 (1). N Tasmania, Waterhouse Passage, 26 Feb 1991, F132712 (1); F132718 (1); Lulworth, Black Rock Point, 22 Nov 1982, F132709 (3); Point Sorell, 19 Jan 1989, F58612 (12); E Devonport, 1–14 Jan 1940, TM H2141 (15); Stanley, Godfrey Beach, 30 Nov 1968, F132715 (1); Port Latta, Cowrie Beach, 1 Dec 1968, F132716 (1). South Australia, Cape Northumberland, 4 Jan 2001, F132706 (1); 6 km E of Port MacDonnell, Stoney Point, 19 Mar 1976, F132721 (2); Cape Jervis, 7 m, 21 Feb 1974, F132708 (1); Kangaroo I., Eastern Cove, 16 Jan 1990, F132705 (5); Streaky Bay, Point Westall, 15 Jan 1991, F132720 (4); Ceduna, Cape Vivonne, 14 Jan 1991, F132710 (15); NW of Thevenard, 14 Dec 1991, F66233 (20).

Description. *Neoamphicyclus* species up to 45 mm long with maximum diameter 7 mm (preserved; tentacles excluded);

perioral thick conical papillae; radial tube feet do not cross true introvert; gonad tubules unbranched.

Ossicles. Body wall, introvert, with sparse table ossicles only: table discs mostly irregular in form, rounded to angular, commonly 32–48 μm wide, rarely up to 64 μm wide, perforations commonly 3–7, rarely up to 11; spires typically with 3 pillars, sometimes 2, rarely 4, frequently absent, spires typically 24 μm long; in small 10-mm long specimens tables numerous, discs up to 88 μm wide, up to 24 perforations, indicating decrease in table disc size, number of disc perforations, and density in body wall with increase in specimen size. Tube feet with endplates up to 224 μm diameter; narrow rim of perforated support plates, elongate, frequently 2 large central perforations, about 112 μm long. Tentacles with rods only, irregular, branched or unbranched, distally with or lacking perforations, some H-shaped, rods 48–136 μm long. Oral disc and papillae with rods only, with perforated ends, lacking rosettes. Posterior anal body wall with 5 rudimentary scales (anastomosing calcareous bodies), irregular form with single-layered perforated stem, up to 400 μm long.

Reproduction. Sexes separate; seasonal reproduction; coelomic brood protection by females; up to 528 coelomic juveniles per female; brood release principally in October and November (Materia et al., 1991, as *N. lividus* from Victoria).

Colour (preserved). Body pale to dark blue-grey to grey-brown with fine speckle, dark blue-grey to grey-black anteriorly and posteriorly; introvert pale to dark grey-brown to brown; tentacle dendritic ends pale grey, trunks dark brown; oral disc dark brown.

Distribution. S New South Wales (Bateman’s Bay), Victoria, N Tasmania (excluding King I.), South Australia, S Western Australia (Princess Royal Harbour, Quaranup (Marsh, 1991)); 0–7 m.

Etymology. Named for Christine Materia in appreciation of her great contribution to echinoderm research through dedicated fieldwork and museum curation, and in particular for her contribution to our knowledge about this species.

Remarks. H. L. Clark (1938, 1946) accepted Joshua (1914) and Joshua and Creed (1915) who mistakenly thought that the common small deep blue-black holothurians on the Victorian coast, with sparse tables usually devoid of a spire, were young of *Cucumaria mutans*. These holothuroids are in fact the *Neoamphicyclus materiae* sp. nov. described here, and distinguished from the other 3 *Neoamphicyclus* species in the key. Joshua’s thinking is confirmed by the fact that one of his syntypes of *Cucumaria mutans* is the new species *N. materiae*. Hickman (1962) reported *Neoamphicyclus lividus* from Devonport. This material was examined and most discs have the characteristic spires of *N. materiae*. Marsh (1991) noted the smaller body size and presence of table spires in specimens from Princess Royal Harbour in SW Australia, and reported the material as “cf. *Neoamphicyclus lividus* Hickman”. These specimens are presumed here to be conspecific with *N. materiae* sp. nov.

Neoamphicyclus mutans (Joshua, 1914) comb. nov.

Figures 1b, 2d, 4e

Cucumaria mutans Joshua, 1914: 4, pl. 1 figs 1a–d (part).—Joshua and Creed, 1915: 18 (part).—H. L. Clark, 1938: 444–445 (part).

Mensamaria thomsoni.—H.L. Clark, 1946: 406 (adult forms; non *Mensamaria thomsoni* (Hutton, 1879).

Cucumella mutans.—Heding and Panning, 1954: 67–68.—A. M. Clark, 1966: 348–349.—Dartnall, 1980: 54, pl. 5, fig. 31, map 16.—Rowe, 1982: 460, 468, fig. 10.34a.—O'Loughlin, 1984: 151.—O'Loughlin and O'Hara, 1992: 227–29.—Rowe, 1995: 273.

Type locality. Victoria, Western Port.

Material examined. *Cucumaria mutans* Joshua, 1914. Lectotype (nominated here). Western Port, Jan 1912, NMV F45138.

Paralectotypes (nominated here): Type locality and lot, F132723 (1); Victoria, F45139 (1).

Remaining syntypes: Specimen removed from F45139 redetermined as *Neoamphicyclus materiae* sp. nov. (F132702); second specimen removed from F45139 determined as *Neoamphicyclus* sp. (F132719; ossicles completely eroded); Western Port, F45140 (microscope slide).

Other material. Victoria, Walkerville, 6 Mar 1982, F76209 (2); Shack Bay, VNPMs stn 27, 4–6 m, 14 Feb 1996, F146578 (1); Western Port, Joshua, Jan 1912, F76477 (1); Crib Point Benthic Survey, 2 m, 13 Apr 1965, F76640 (1); Shoreham, 30 Mar 1902, F76083 (1); McHaffies, 7 Feb 1970, F45246 (1); Flinders, ocean platforms, 22 Jan 1982, F76076 (2); 17 Feb 1990, F76609 (6); Port Phillip Bay, southern, 38°17' S, 144°38' E, 3–6 m, 30 Mar 1986, F136913 (3); Cheltenham beach, 20 Jul 1891, F76085 (6). N Tasmania, Waterhouse Passage, 26 Feb 1991, F146576 (9); Tamar R., Greens Beach, 3 May 1986, F146577 (8); Point Sorell, 19 Jan 1989, F146579 (2); King I., 9 Mar 1980, F146575 (2). South Australia, Victor Harbor, 9 Nov 1988, F146574 (1); Glenelg, Jul 1979, F76089 (1); Kangaroo I., NE Eastern Cove, rocky shallows, 16 Jan 1990, F136915 (1); Emu Bay, 17 Jan 1990, F136916 (1); Port Lincoln, North Shore, 14 Feb 1970, F136912 (1); dredged, Jan 1968, F136914 (1); Streaky Bay, Point Westall, Smooth Pool, 15 Jan 1991, F109315 (3). Western Australia, Perth, Cottesloe, *Sargassum* beds, 6 Feb 2007, WAM Z37473 (1).

Description. *Neoamphicyclus* species up to 60 mm long with maximum diameter 25 mm (preserved; tentacles excluded); perioral blunt to thick conical papillae; paired single radial series of tube feet usually cross true introvert, sometimes only a few present; gonad tubules not branched.

Ossicles. Body wall, introvert, with abundant table ossicles only: table discs sometimes regular (sub-triangular with 3 large 3 small perforations), mostly irregular in form, disc size range 72–136 μ m wide, frequently about 112 μ m wide; perforations 6–23; pillars 3–5, predominantly 3, typically 48 μ m long. Tube feet with endplates up to 320 μ m diameter; few elongate, irregular, perforated support plates, about 168 μ m long. Tentacles with rods, rosettes both basally and distally, tables, and intergrading forms up to 184 μ m long; rods plate-like, perforated, irregular in form; rosettes plate-like with small close perforations, largest with large central perforations, some with secondary layer developments, rosettes up to 136 μ m long; table discs 44–88 μ m wide, 4–20 perforations, 2–4 pillars. Posterior anal body wall with 5 rudimentary scales (anastomosing calcareous bodies), irregular form, up to 520 μ m long.

Colour. Live: body violet-grey to blue-grey, frequently with some purple colouration, darker anteriorly and posteriorly. Preserved: body pale to dark brown, to brown-grey, to blue-grey, to violet-black, darker anteriorly and posteriorly; introvert brown to off-white; tentacle trunks pale grey, brown flecks, white lumps, lacking basal white band; tentacle dendritic branches dark brown; disc with brown markings.

Distribution (this work). Victoria, W of Wilsons Promontory (Walkerville), N Tasmania, to SW Western Australia (Perth); 0–6 m.

Remarks. H. L. Clark (1938) judged material from Bunkers Bay (Margaret River) and Cottesloe (Perth) in SW Australia to be *Cucumaria mutans* Joshua, 1914. This material was not examined here and confirmed as *N. altoffi* sp. nov. or *N. mutans* (Joshua). Subsequently H. L. Clark (1946) synonymised *Cucumaria mutans* Joshua, 1914 with *Mensamaria thomsoni* (Hutton, 1879), and referred material from the western side of the Great Australian Bight (165 m), Bunkers Bay and Perth to this species. The specimen from the Great Australian Bight was not examined here and confirmed as *N. altoffi* or *N. mutans*. H. L. Clark (1946) commented that “further study of this holothurian in New Zealand, Victoria and Western Australia may show that at least 2 and possibly 3 species are at present confused under one name”. Later Heding and Panning (1954) raised *Cucumaria mutans* Joshua, 1914 out of synonymy, and reassigned the species to *Cucumella* Ludwig and Heding, 1935. This decision was based on an erroneous assessment of tentacle number, as discussed under *Neoamphicyclus* Hickman (above), and *C. mutans* is re-assigned here to *Neoamphicyclus*.

As indicated in the material examined a lectotype and paralectotypes are nominated here. One syntype specimen is determined as *Neoamphicyclus materiae* sp. nov., and one syntype specimen with completely eroded ossicles can no longer be determined to species and remains *Neoamphicyclus* sp. Hickman (1962) reported *Cucumella mutans* from SE Tasmania (Derwent Estuary; TM H2139). The specimens were re-examined here and determined as *N. altoffi* sp. nov. (above). No specimens of *N. mutans* from southern Tasmania have been seen in this work. Marsh and Pawson (1993) determined “with some doubt” as *Cucumella mutans* (Joshua, 1914.) a small specimen (7 mm long), lacking tentacles, from 30 m at Rottneest I. (SW Australia). The form of the body wall tables is illustrated, and has some resemblance to those of *N. mutans*, but the average disc diameter (49 μ m) is significantly smaller. Tables with curved discs from tube feet are illustrated, and these have not been found in *N. mutans*. Many specimens from across southern Australia, previously identified as *Cucumella mutans*, are recognized in this work as a new *Neoamphicyclus* species (*N. altoffi* sp. nov., above). *N. mutans* is distinguished from the other 3 species of *Neoamphicyclus* in the key.

Neocucumella Pawson, 1962

Neocucumella Pawson, 1962: 65.—Pawson, 1963: 22.—Pawson, 1970: 31.—O'Loughlin and O'Hara, 1992: 250 —Rowe, 1995: 276.

Type species. *Pseudocucumis bicolumnatus* Dendy and Hindle, 1907 (originally monotypic).

Other species. *Neocucumella fracta* O'Loughlin and O'Hara, 1992; *N. turnerae* O'Loughlin, sp. nov.

Diagnosis. See emended diagnosis in O'Loughlin and O'Hara (1992).

Distribution. New Zealand (7–239 m; Pawson, 1970); SE Australia (SE Tasmania; Derwent Estuary; Bass Strait; Spencer Gulf; 10–110 m).

***Neocucumella turnerae* sp. nov.**

Figures 1f, 2b, 4f

Material examined. Holotype: SE Tasmania, Derwent Estuary, Blackmans Bay, on beach after storm, E. Turner, 12 Jun 1988, TM H3295.

Paratypes: Type locality and date, TM H3296 (10).

Other material. Type locality and date, TM H1983 (33); SS02/2007 stn 2, 146.98°E, 43.69°S, 100–110 m, 29 Mar 2007, F136939 (1).

Description. Up to 60 mm long (preserved, tentacles partly extended), maximum diameter 8 mm; body form subcylindrical, long, thin, tapering orally and anally; ring of 20 dendritic tentacles, 5 pairs of large interradial, 5 pairs of small radial; lacking collar of papillae around tentacle ring; tube feet in 5 paired radial series, continuous across true introvert; dense collar of about 100 conspicuous pointed perioral papillae; 5 radial pairs of minute perianal papillae; ring not composite, lacks posterior prolongations; radial plates subrectangular, anterior notch, posterior notch with short projections upturned; interradial plates small, inverted V shape; dorsal twisting stone canal (1 mm long), with bean-like madreporite (1 mm long); 3 ventral long thin tubular polian vesicles up to 20 mm long; longitudinal muscles broad, flat, undivided; tufts of long, thin unbranched gonad tubules on each side of dorsal mesentery; respiratory tree weakly dendritic, extending coelom length to vascular ring.

Ossicles. Mid-body wall, introvert, lacking ossicles (except tube feet). Tube feet: endplates up to 240 μ m diameter, slightly smaller perforations centrally; few perforated support plates, typically 96 μ m long, 2 large perforations centrally, smaller perforations distally, denticulate on one side, form narrow rim around endplate; fine rods, thin, straight, perforated distally, typically 80 μ m long; rosettes in tube feet of introvert. Tentacles: smooth rods, distally perforated or bifurcate, up to 120 μ m long. Oral disc: densely branched rosettes, up to 64 μ m long, irregularly oval. Oral papillae: rosettes intergrading with unbranched and distally branched and intertwined irregular rods, variably perforated. Posterior anal body wall: 5 rudimentary scales (anastomosing calcareous bodies), irregularly oval to elongate, up to 240 μ m long; smooth distally perforated rods, up to 64 μ m long; irregular oval table-like discs, up to 48 μ m long, lacking spires.

Colour. Colour in life “pale pink” (E. Turner pers. comm.). Preserved colour of body and tube feet off-white; tentacles dark to pale brown to off-white; dark brown flecking on oral disc.

Distribution. SE Tasmania, Derwent Estuary, sediment; sublittoral to 110 m.

Etymology. Named for Mrs Elizabeth Turner, of the Tasmania Museum and Art Gallery, for her gracious assistance with loans and data over many years, and for collecting most of the specimens of this new species.

Remarks. Pawson (1962) erected the monotypic genus *Neocucumella* for the New Zealand species *Pseudocucumis bicornatus* Dendy and Hindle, 1907. O'Loughlin and O'Hara (1992) added *Neocucumella fracta* for SE Australia, and discussed the generic diagnosis. *Neocucumella turnerae* sp. nov. has the tentacle number and form, tube feet arrangement, tube feet ossicle forms, and distinctive calcareous ring of *Neocucumella*, but is unique and exceptional in completely lacking table ossicles. Such a significant diagnostic difference suggests the desirability of erecting yet another cucumariid genus, but I judge that this should not be done until appropriate molecular data is available for a revision of *Neocucumella* Pawson and related genera.

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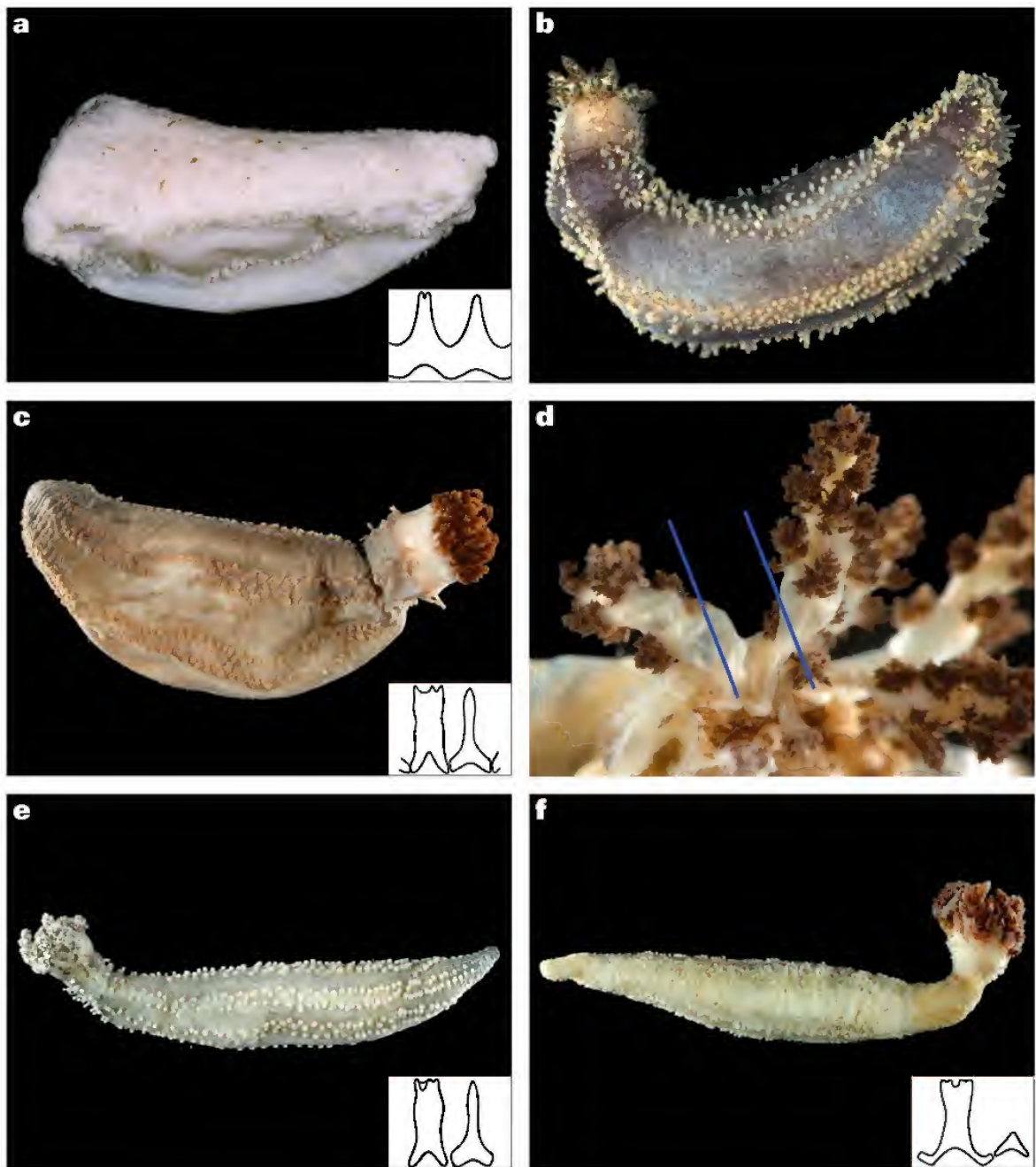


Figure 1. a, *Apsolidium falconerae* sp. nov., holotype, from Phillip I., NMV F109375, preserved, 34 mm long, lateral view showing thick calcaireous dorsal and lateral body, thin-walled sole, mid-ventral radial tube feet; insert with radial (left) and interradial (right) plates of calcaireous ring. b, *Neoamphicyclus mutans* (Joshua, 1914), live colour, collected by Mark O'Loughlin from Flinders ocean platforms on 13 February 2007, 60 mm long, lateral view, NMV F123862. c, *Neoamphicyclus altoffi* sp. nov., holotype, from Fremantle, WAM Z279-92, preserved, 33 mm long, dorso-lateral view; insert with radial (left) and interradial (right) plates of calcaireous ring. d, *Neoamphicyclus altoffi* sp. nov., tentacles showing white calcaireous band of ossicles at base, NMV F132704. e, *Neoamphicyclus materiae* sp. nov., holotype, from Flinders, NMV F132722, preserved, 35 mm long, ventral view; insert with radial (left) and interradial (right) plates of calcaireous ring. f, *Neocucumella turnerae* sp. nov., holotype, from Derwent estuary, TM H3295, preserved, 46 mm long; insert with radial (left) and interradial (right) plates of calcaireous ring.

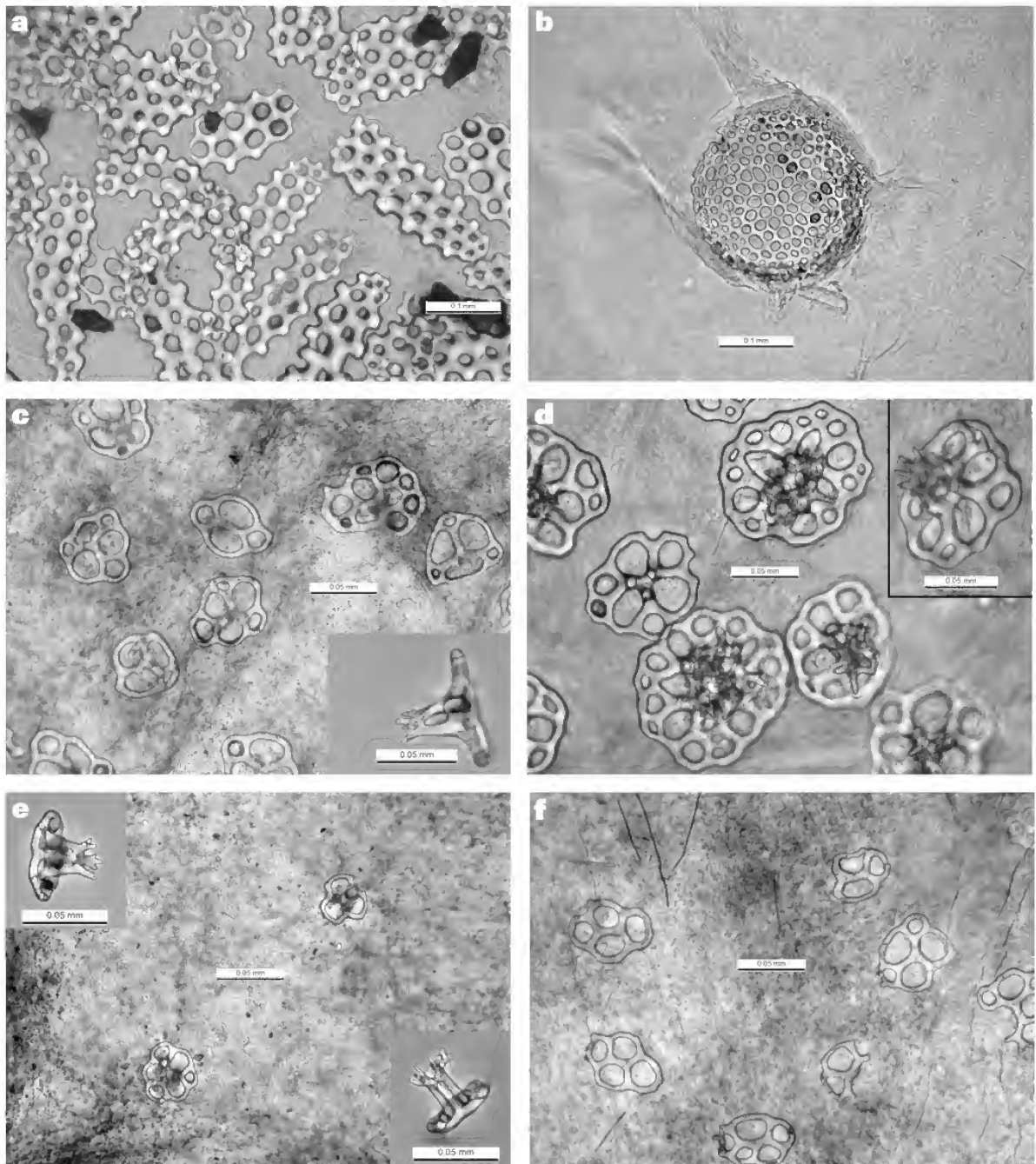


Figure 2. Body wall mounts. a, *Apsolidium falconerae* sp. nov., holotype, NMV F109375, knobbed plates in ventral body wall. b, *Neocucumella turnerae* sp. nov., paratype, TM H3296, endplate in ventral body wall; absence of other ossicles. c, *Neoamphicyclus altoffi* sp. nov., holotype, WAM Z279-92, table discs in body wall; insert with lateral view of table showing spire, NMV F132704. d, *Neoamphicyclus mutans* (Joshua, 1914), NMV F109315, table discs in body wall; insert showing table spire. e, *Neoamphicyclus materiae* sp. nov., paratype NMV F76360, table discs in body wall; inserts with lateral view of tables showing spires, paratype, NMV F76364. f, *Neoamphicyclus lividus* Hickman, 1962, table discs in body wall, NMV F58698.

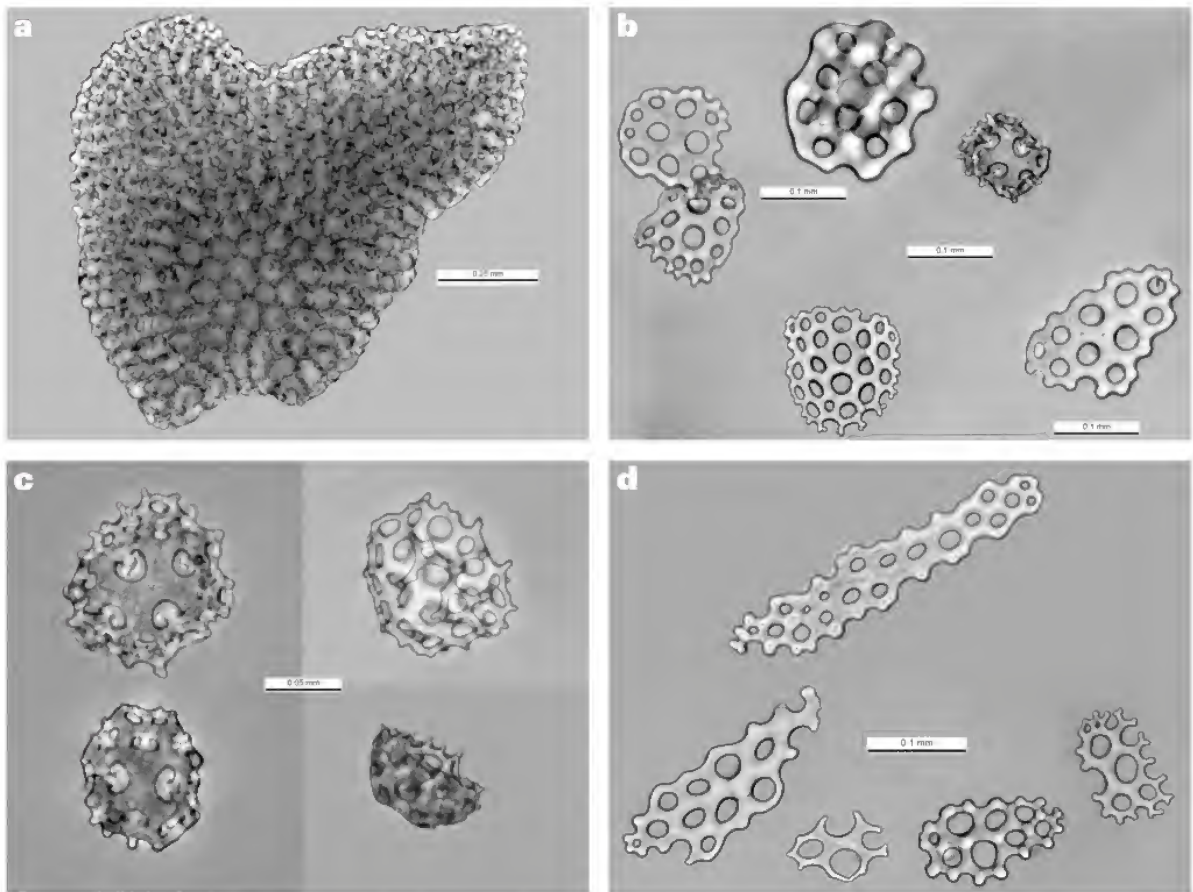


Figure 3. *Apsolidium falconerae* sp. nov., ossicles, holotype, NMV F109375. a, scale (multilayered ossicle) from dorsal body wall. b, dorsal body wall; knobbed button and cup (top right); 4 perforated tube foot support plates. c, partially “closed” cups from dorsal body wall; 2 views of cross at base of cups (left); view of partially closed top of cup (upper right); lateral view of cup (lower right). d, ventral body wall (sole); elongate knobbed plate (upper); 4 tube foot support plates (lower).

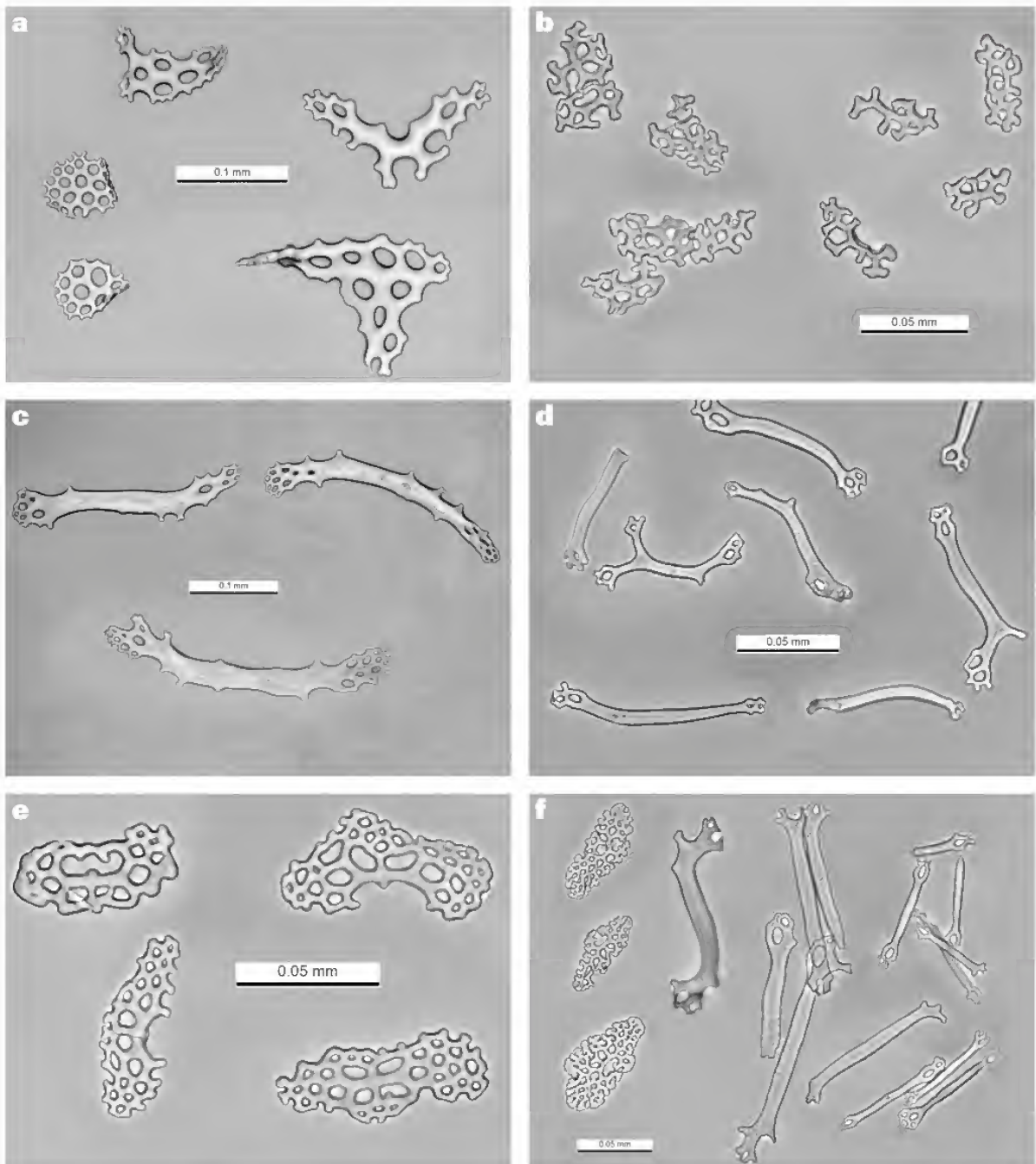


Figure 4. Tentacle ossicles. a, *Apsolidium falconerae* sp. nov., holotype, NMV F109375, perforated plates and rods. b, *Neoamphicyclus altoffi* sp. nov., rosettes from lower tentacle (base), NMV F132704. c, *Neoamphicyclus altoffi* sp. nov., rods from upper tentacle, NMV F132704. d, *Neoamphicyclus materiae* sp. nov., paratype, NMV F76364, rods. e, *Neoamphicyclus mutans* (Joshua, 1914), NMV F109315, rosettes from upper tentacle. f, *Neocucumella turnerae* sp. nov., paratype, TM H3296; rosettes from disc and oral papillae (left); rods from tentacles (right).

New *Holothuria* species from Australia (Echinodermata: Holothuroidea: Holothuriidae), with comments on the origin of deep and cool holothuriids

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Abstract

O'Loughlin, P. M., Paulay, G., VandenSpiegel D., and Samyn, Y. 2007. New *Holothuria* species from Australia (Echinodermata: Holothuroidea: Holothuriidae), with comments on the origin of deep and cool holothuriids. *Memoirs of Museum Victoria* 64: 35–52.

Two aspidochirotid species, new to science, from the continental slope of southern Australia are described: *Holothuria* (*Panningothuria*) *austrinabassa* O'Loughlin sp. nov. and *Holothuria* (*Halodeima*) *nigralutea* O'Loughlin sp. nov. The first represents the southernmost documented holothuriid, and is the sister species of the northernmost holothuriid species *Holothuria* (*Panningothuria*) *forskali* Delle Chiaje. The second is a very recent offshoot of the wide-ranging Indo-west Pacific *Holothuria* (*Halodeima*) *edulis* Lesson. Morphological and molecular genetic differences between these species pairs are detailed. *Holothuria* (*Halodeima*) *signata* Ludwig is raised out of synonymy with *H. edulis*. A lectotype for *Holothuria* (*Halodeima*) *signata* Ludwig is designated. The status of the subgenera *Panningothuria* Rowe and *Halodeima* Pearson is discussed. The occurrence of multiple madreporites in *Halodeima* is discussed.

Keywords

Echinodermata, Holothuroidea, Holothuriidae, *Holothuria*, taxonomy, new species, new lectotypes.

Introduction

The Holothuriidae is one of the most diverse families of sea cucumbers, with the bulk of this diversity in shallow, tropical waters. Of the more than 185 species (Samyn et al., 2005) currently recognized, all but a handful thrive in the tropics, predominantly on coral reefs, at less than 50 m depths. It is therefore noteworthy that recent surveys in Australia revealed two new deepwater species from subtropical to warm temperate latitudes. Specimens of the two new *Holothuria* species were collected from the continental slope off western and south-western Australia during the survey SS10/2005 by Australia's national science agency, the Commonwealth Scientific and Industrial Research Organization (CSIRO), that is aiming "to characterize benthic ecosystems off Western Australia". This was commenced through the Marine National Facility by the RV *Southern Surveyor* in the last months of 2005. Additional specimens were discovered in the collections of Museum Victoria. To ascertain the subgenera to which the two new species belong, comparative morphological and molecular studies were undertaken.

Methods

Genetic characterization was pursued by sequencing portions of the mitochondrial 16S (large subunit) RNA and cytochrome oxidase I (COI) genes. Ethanol-fixed tissues of the new taxa,

related species, and outgroup taxa (see Table 1 for voucher information) were macerated, digested in DNAzol[®] and proteinase K overnight, and genomic DNA isolated using standard procedures (Meyer, 2003). Genomic DNA of most samples was cleaned using the Qiagen polymerase chain reaction (PCR) cleanup kit, following manufacturer's protocols, except that cleaned DNA was resuspended in TE buffer. Qiagen cleanup helped eliminate problems with inhibition prevalent in holothurian samples.

An approximately 1120 bp long (1119 bp in *H. nigralutea* G255) section of the large subunit of the mitochondrial ribosome RNA gene (16S) was amplified with a pair of overlapping primers. 16Sc1 (TACCTT[T/G]TGTAT[T/A]ATGG[T/A]TTAAC) and 16Sc2 (TGATTATGCTACCTTNGCAC) (designed new) amplified 678 bp, and 16SAR (CGCCTGTTTATCAAAACAT) and 16SBR (GCCGGTCTGAACTCAGATCACGT) (Palumbi, 1996), amplified 510 bp in *H. nigralutea* (G255). A 651 bp length of the mitochondrial cytochrome oxidase subunit 1 gene was amplified with primers COIeF (ATAATGATAGGAGGRITTTGG) COIeR (GCTCGTGTRTCTACRTCCAT) (Arndt et al., 1996). PCR products were sequenced at the University of Florida's ICBR center. Electropherograms were edited in Sequencher, aligned with Clustal X, and adjusted by eye. Sequences are deposited in GenBank (see Table 1 for GenBank and voucher information). Sequence data from the two gene regions were analyzed as a

single concatenated dataset. Parsimony trees were generated by PAUP (version 4, Swofford, 2003), with 100 bootstrap replicates. Bayesian analyses were run using Mr. Bayes (version 3.1.2, Ronquist and Huelsenbeck, 2003), with MC³, GTR-I-Gamma, an uninformative prior, for 10 million generations. GTR-I-Gamma was chosen as the simplest model of evolution that fitted the data, using the Akaike Information Criterion as implemented by the program Modeltest 3.6 (Posada and Crandall, 1998), for each gene region as well as for the combined sequences. Indels were included in the analysis. There was no evidence for pseudogene sequences in any of several hundred specimens of *Holothuria* sequenced to date; all reads were clean and unambiguous.

For scanning electron microscopy (SEM), ossicles were

cleared of associated soft tissues in commercial bleach. They were then air-dried, mounted on aluminium stubs, coated with gold, and observed with a JEOL JSM-6480LV scanning electron microscope.

Abbreviations for institutions are: MNHN—Musée national d'Histoire naturelle, Paris; NMV—Museum Victoria, Australia; RBINS—Royal Belgian Institute of Natural Sciences; UF—Florida Museum of Natural History; UH—Zoologisches Museum, Universität Hamburg; UM—University of Murcia, Spain; USNM—United States National Museum of Natural History, Smithsonian Institution, Washington.

Specimen registration number prefixes are: MNHN EcHh; NMV F; RBINS IG; UF E; UH E; UM HO; USNM E.

Table 1. Specimens sequenced. GenBank accession numbers given for gene regions.

Voucher	Extraction	Species	Locality	16Sc	16SAR	COIe
NMV F94742	N10	<i>Stichopus ocellatus</i>	Papua New Guinea	EU220793	EU220793	EU220814
UF E4834	G188	<i>Actinopyga obesa</i>	Hawaii	EU220794	EU220794	EU220815
UF E4901	N82	<i>Bohadschia</i> sp. nov.	Hawaii	EU220795	EU220795	EU220816
UF E1595	G80	<i>H. excellens</i>	Palau	EU220796	EU220796	EU220817
NMV F110524	G257	<i>H. austrinabassa</i>	W Australia	EU220797	EU220797	EU220818
UF E4480	G200	<i>H. forskali</i>	Portugal	EU220798	EU220798	EU220819
UF E4831	G186	<i>H. atra</i>	Hawaii	EU220799	EU220799	EU220820
UF E4460	G175	<i>H. grisea</i>	Florida	EU220800	EU220800	no
UF E3359	G247	<i>H. kefersteini</i>	Panama	EU220801	EU220801	no
UF E4877	G259	<i>H. mexicana</i>	Belize	EU220802	EU220802	EU220821
UF E4822	G230	<i>H. floridana</i>	Florida	EU220803	EU220803	EU220822
NMV F120437	N120	<i>H. nigralutea</i>	W Australia	EU220804	no	EU220823
NMV F111290	G255	<i>H. nigralutea</i>	W Australia	EU220805	EU220805	EU220824
UF E3644	N3	<i>H. edulis</i> "brown" form	Cocos-Keeling	EU220806	EU220806	EU220825
UF E2065	J292	<i>H. edulis</i> typical form	Oman	EU220807	EU220807	EU220826
UF E4987	K140	<i>H. edulis</i> fuschia form	Philippines	EU220808	no	EU220827
UF E4746	G104	<i>H. edulis</i> typical form	Guam	EU220809	EU220809	EU220828
UF E3884	J282	<i>H. edulis</i> grey form	Okinawa	EU220810	EU220810	EU220829
UF E3882	J296	<i>H. edulis</i> grey form	Okinawa	EU220811	EU220811	EU220830
UF E325	G50	<i>H. signata</i>	Rangiroa	EU220812	EU220812	EU220831
UF E329	G55	<i>H. signata</i>	Rangiroa	EU220813	EU220813	EU220832

Table 2. Characters distinguishing *H. (Panningothuria) austrinabassa* O'Loughlin sp. nov. and *H. (Panningothuria) forskali* Delle Chiaie

Characters	<i>H. austrinabassa</i>	<i>H. forskali</i>
Body colour	Grey-brown, small brown spots	Black to dark brown
Papilla tubercles	Distinct, ocellate, off-white	Same colour as body wall
Tables in body wall	Abundant, fully developed	Sparse to absent, reduced form
Dorsal table discs	> 50 µm wide	< 50 µm wide
Spire of tables	Always fully developed	Rarely fully developed
Papillae rods	Unbranched rods absent	Unbranched rods present
Tentacle tables	Present, reduced form	Absent
Tube feet	Spinous rods present	Spinous rods absent
Distribution	W and S Australia	NE Atlantic, Mediterranean Sea

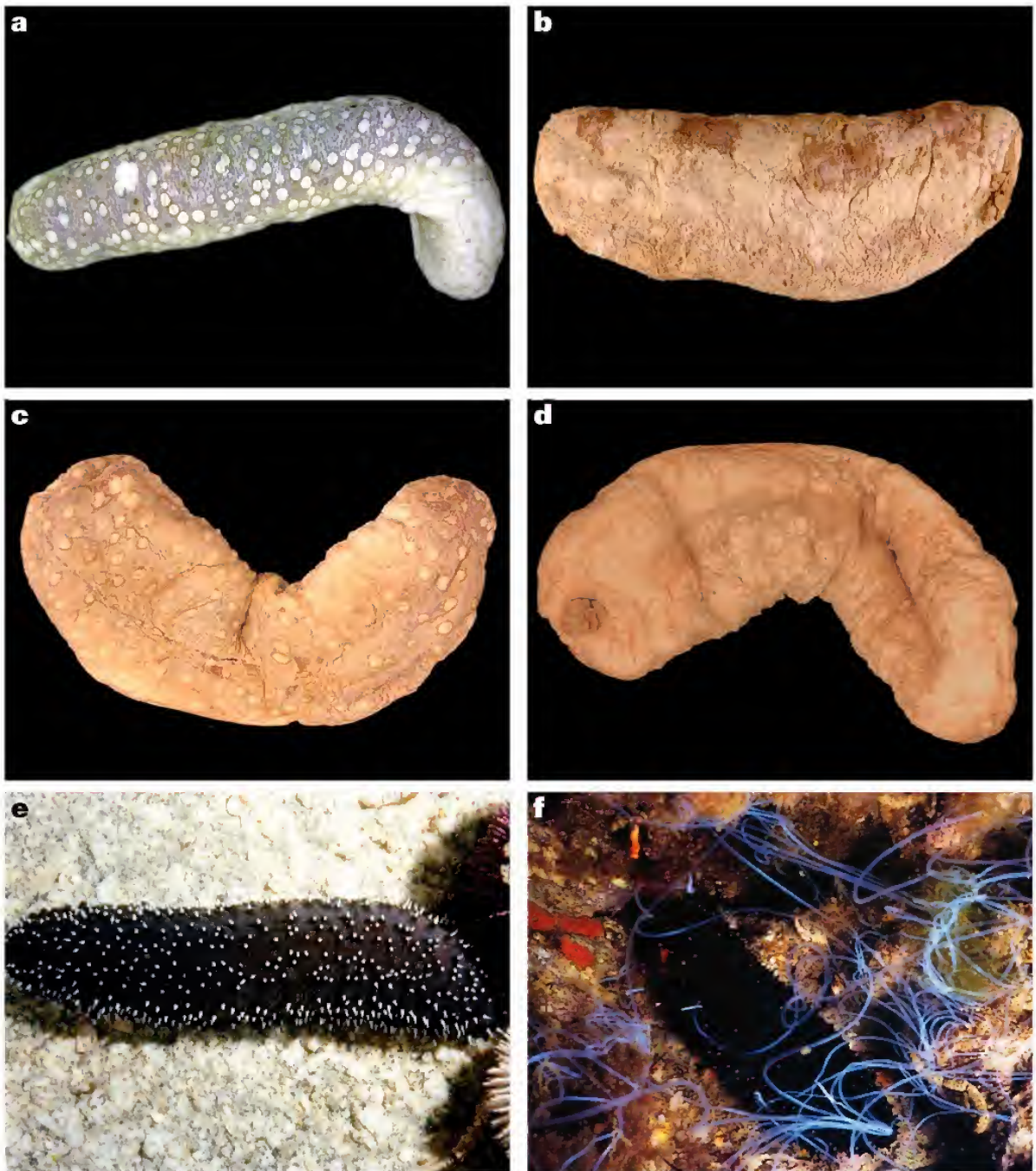


Figure 1. a, live *Holothuria* (*Panningothuria*) *austrinabassa* O'Loughlin sp. nov, from Western Australia, off Perth (380 mm long; NMV F110523; photo by Karen Gowlett-Holmes). b, preserved *H. (Panningothuria) austrinabassa*, from Western Australia, off Albany (250 mm long; tentacles at right; NMV F120438; photo by David Staples). c, d, preserved holotype of *H. (Panningothuria) austrinabassa*, from Victoria, off Portland (170 mm long; oral end left; NMV F120447; photos by David Staples): c, dorsal view; d, ventral view. e, live *H. (Panningothuria) forskali* Delle Chiaje, in aquarium in Mons, Belgium (130 mm long; photo by Didier VandenSpiegel). f, live *H. (Panningothuria) forskali*, from south of France, off Banyuls, showing expulsion of cuvierian organ tubules (photo by Didier VandenSpiegel).

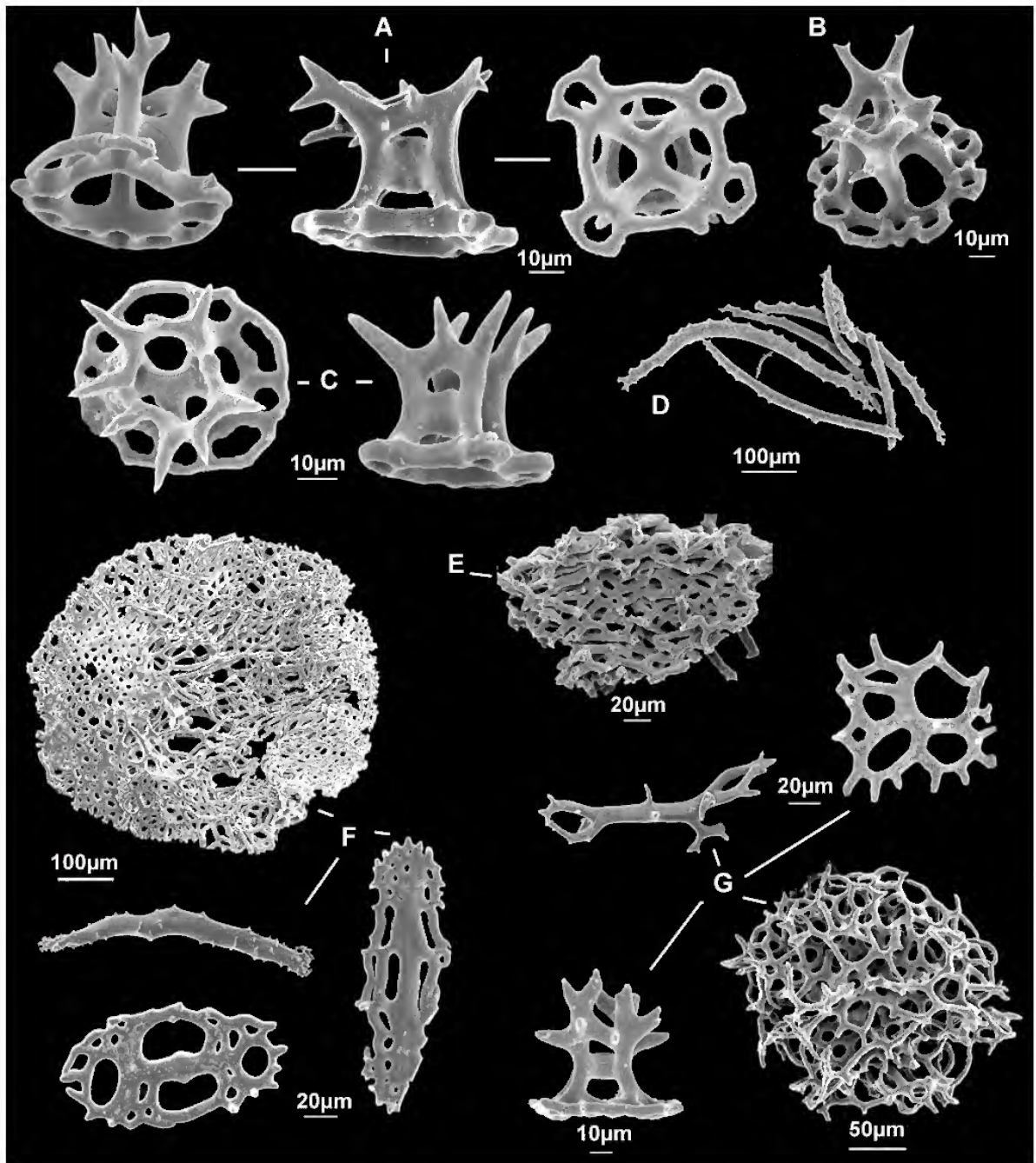


Figure 2. *Holothuria (Panningothuria) austrinabassa* sp. nov. (SEM of ossicles from NMV F120447 and NMV F120438). A, dorsal body wall; B, anal body wall; C, ventral body wall; D, tentacles; E, madreporite; F, tube feet; G, papillae.

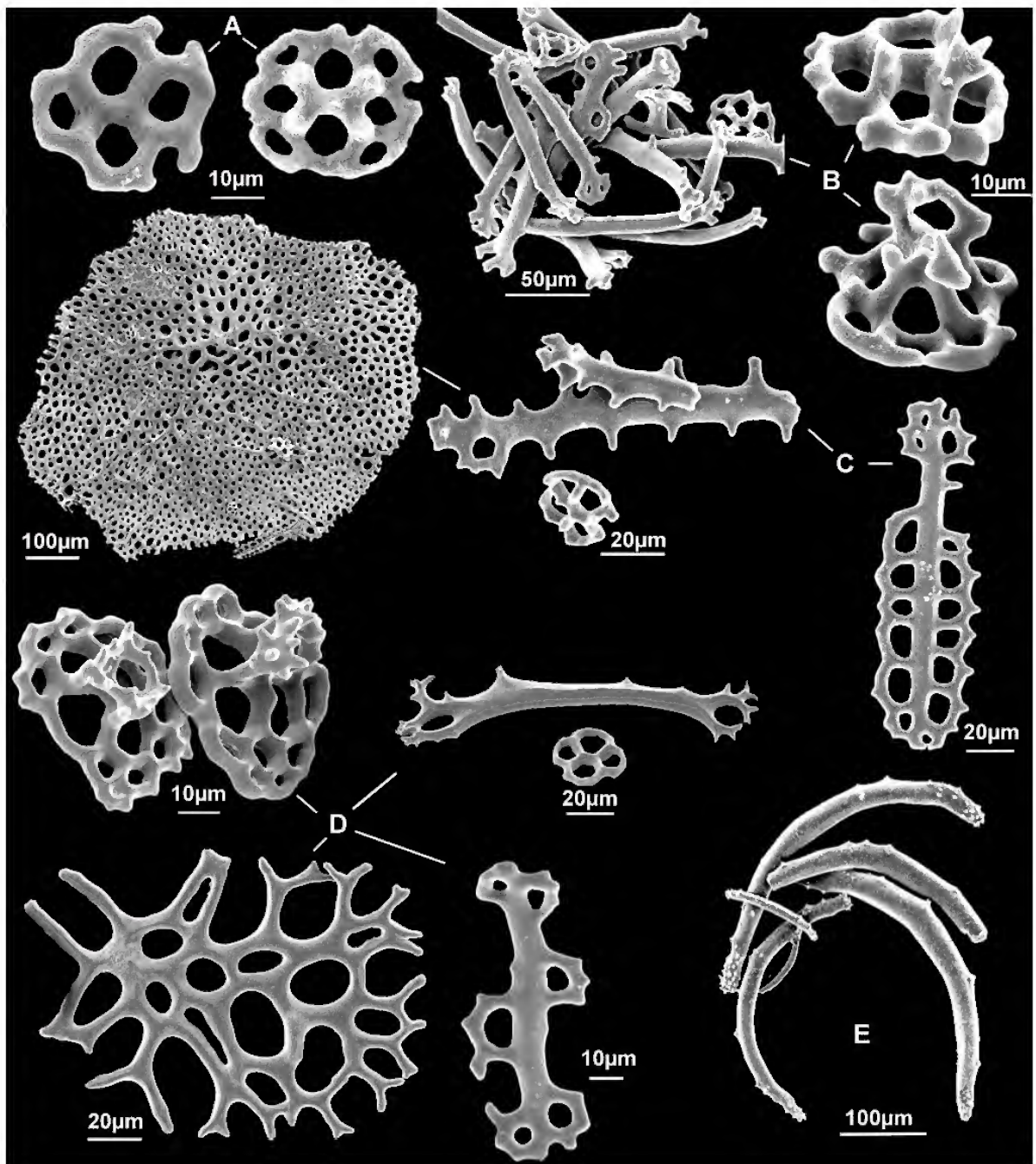


Figure 3. *Holothuria (Panningothuria) forskali* Delle Chiaje, 1823 (SEM of ossicles from HO-1854). A, oral body wall; B, anal body wall; C, tube feet; D, dorsal papillae; E, tentacles.

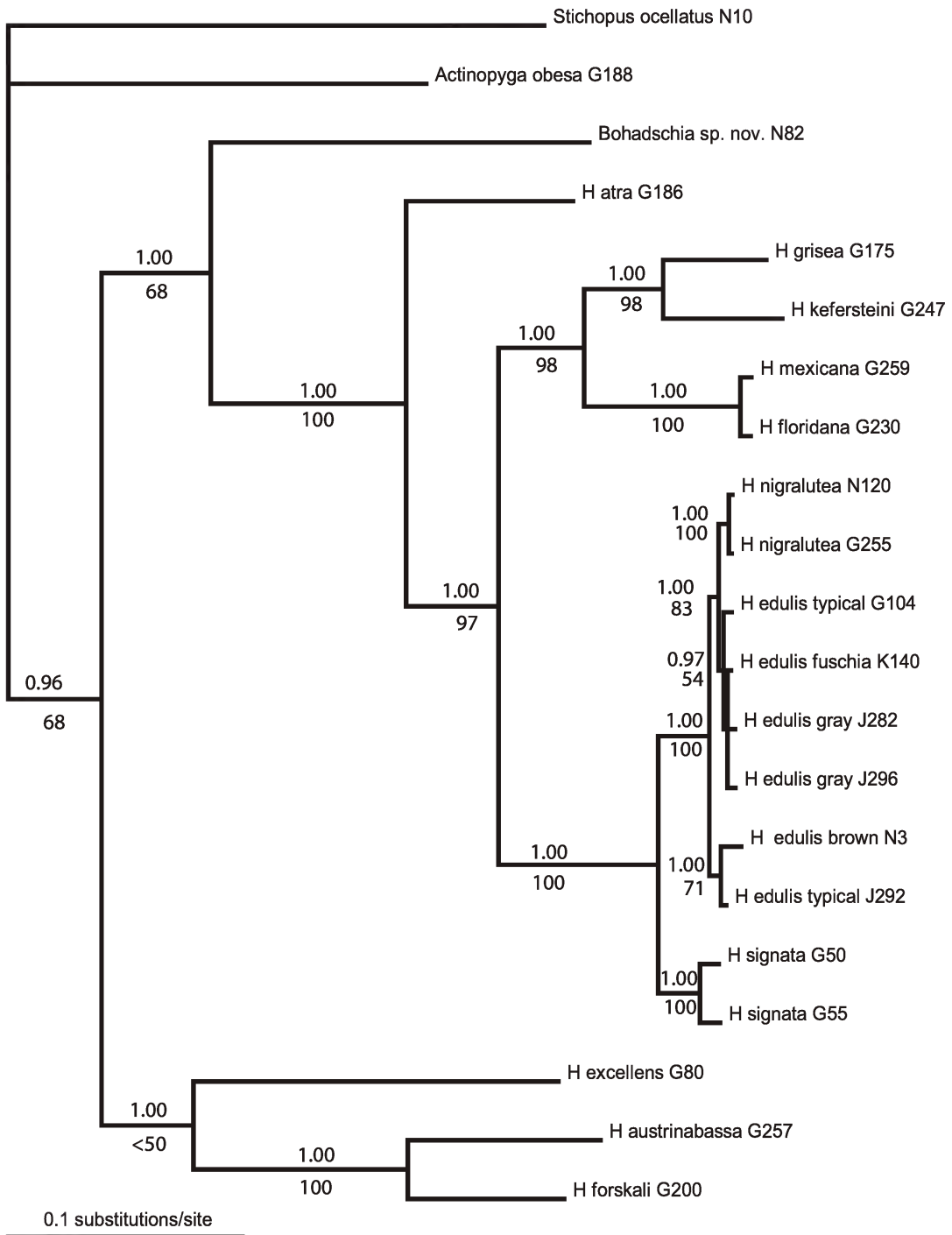


Figure 4. Bayesian phylogram of species studied together with selected outgroup taxa, with posterior probability values (10 million generations, GTR-I-Gamma, and uninformative prior) above branches, and parsimony bootstrap values (100 replicates) below.

***Holothuria (Panningothuria) austrinabassa* O'Loughlin sp. nov.**

Figures 1–4, Tables 1, 2.

Material examined. Holotype: Australia, Victoria, 27 miles SW of Portland, approx. 39°S, 141°E, 293–329 m, *Aquarius*, M. Gomon and R. Plant, May 1979, NMV F120447.

Paratypes: Type locality and date, F109370 (2).

Other material. Western Australia, *Southern Surveyor*, Nov/Dec 2005, SS10/2005 stn 90, off Abrolhos Is, 389–407 m, F110525 (1); SS10/2005 stn 78, off Jurien Bay, 414–401 m, F110524 (3); SS10/2005 stn 6, off Two Rocks (Perth), 329–370 m, F110523 (2); SS10/2005 stn 32, off Bald I. (Albany), 728–710 m, F111301 (1); SS10/2005 stn 34, off Bald I., 431–408 m, F111286 (2); F110526 (2); SS10/2005 stn 39, off Bald I., 97–99 m, F120438 (1); off Cervantes, 30°16' S, 114°30' E, 600–800 m, 8 Feb 1991, F120441 (2); Great Australian Bight, 33°19' S, 127°24' E, 300–310 m, 27 Feb 1976, F120442 (1); South Australia, SW of Beachport, 37°49' S, 139°45' E, 24 Dec 1981, F120439 (1); Victoria, 20.5 miles S of Cape Nelson, 403 m, 10 Mar 1977, F120440 (1).

Comparative material examined. *Holothuria (Panningothuria) forskali* Delle Chiaje, 1823. NE Atlantic Ocean, Portugal, Algarve, Estrajada, 20 m, between rocks, UM HO-1854 (1).

Description (preserved specimens). Body up to 250 mm long, up to 70 mm wide (F120438); elongate, not tapering from mid-body, rounded anteriorly and posteriorly, oval in transverse section, longitudinal, deep, mid-ventral furrow frequently present. Body wall firm-leathery, up to 20 mm thick (F120438). Dorsal and lateral body surface pustulose, wrinkled; tubercles scattered irregularly dorsally and laterally, flat, ocellate, “wart-like”, oval to round, variable size, up to 2–10 mm across, sometimes contiguous, with papillae extending as small nipple-like projections, 1 mm high 0.5 mm wide, 3–12 mm apart, lacking ampullae. Ventral surface soft, pustulose, wrinkled, tube feet hard to discern, arranged in very irregular, scattered, paired series along ventral radii, about 5 mm apart (F110524), tube feet lacking ampullae. Mouth ventral, surrounded by irregular collar of about 50 inconspicuous oral papillae evident only in largest specimen (F120438); tentacles 20, peltate, with long, thin, tubular tentacle ampullae extending off calcareous ring plates, subequal, up to 25 mm (F109370) long. Anus terminal, lacking anal teeth. Left dorsolateral radial plate of calcareous ring 7 mm wide 5 mm high, with 4 anterior points, posterior margin with shallow rounded indentation. Left dorsolateral interradiial plate 3 mm high, 3 mm wide, anterior spire, posterior margin with rounded indentation (F110526). With single dorsal stone canal/madrepore, stone canal 1 mm long with attached madrepore 2 mm long (F109370), to stone canal 2 mm long with attached madrepore 3 mm long (F120441, F120442, F120438). With 1 or 2 sac-like polian vesicles, 12 mm (F110526) to 33 mm (F120441) long, narrowed distally; 2 polian vesicles in holotype, 30 and 15 mm long. Longitudinal muscles flat, broad, thin median groove, dorsal bands up to 12 mm wide, ventral bands up to 30 mm wide (F120438). Gonadal tubules long, thin, multiple branching, extending to mid-body. Respiratory tree extending to anterior end. Cuvierian organ present, tubules up to 25 mm long, 1.5 mm in diameter, not branched. Gut contents calcareous detritus, fragments up to 10 mm long.

Ossicles. Dorsal body wall with numerous tables only; tables variable in size, variable in form of disc and spines; disc

52–72 μ m in diameter, with 4–8 perforations, with alternating narrow and wide perforations that give slightly angular, quadrate aspect to disc, sometimes with fine spinelet at edge; spire with 4 pillars, typically 40 μ m high (including spines), single cross-beam, crown with conspicuous spines that may extend beyond disc margin, these spines variable in length and form, up to 32 μ m long, straight, curved, forked, with side branch. Dorsal papillae with tables, perforated plates, spinous spherical bodies; tables as for body wall, but some larger, with discs to 96 μ m across, spires up to 64 μ m high; plates irregularly rectangular (up to 144x128 μ m) to narrowly oval (184x80 μ m), plates formed around thick central rod, with large perforations centrally with angular edges and smaller perforations marginally with angular edges, and bluntly spinous marginal edge; reticulate spinous spherical body at apex of papilla, 320 μ m wide. Ventral body wall with tables only, tables similar in form to dorsal ones, but often smaller, discs to 48 μ m wide only, spire to 32 μ m high only. Tube feet with endplates, support plates, support rods; endplates irregularly oval, up to 600 μ m long, of complex form, partly single-layered plate with small perforations or mesh-like, partly with incomplete mesh-like secondary layering; support plates more elongated and more finely perforate than in papillae, up to 200 μ m long; support rods rare, thick, curved, with some thick spines on outer edge, up to 120 μ m long. Body wall around anus with tables and rods; tables as dorsally, but many larger, disc to 80 μ m wide, spire 48 μ m long; rods rare, thick, bent, with rugose spinous surface, up to 552 μ m long. Tentacles with rods, reduced tables; rods thick to thin, rarely with terminal perforations, rarely branching, with thick spines, up to 652 μ m long; tables irregular, mostly lacking a spire, discs 48–80 μ m wide, spire up to 24 μ m long if present, disc with 4–18 perforations, disc variably with bluntly spinous margin. Stone canal/madrepore with massed irregular rods, some branched, some branches anastomosing to form perforations, some with irregularly perforated mesh.

Tentacle ampullae, polian vesicles, gonad tubules, respiratory trees, longitudinal muscles, circular muscles, wall of cloaca and cuvierian organ devoid of ossicles.

Colour. Colour (live): background colour grey dorsally and dorsolaterally, yellowish laterally, and off-white ventrally. Dorsal and lateral tubercles white “wart-like” flat papillae cones with green margin and small dark central spot. Body with grey-brown spots in addition to dark papillae spots. Colour (preserved): background colour grey-brown dorsally and dorsolaterally, brown to pale brown ventro-laterally and ventrally. Tubercles off-white with small dark brown or off-white central papilla. Body with scattered grey-brown spots in addition to papillae spots. Tube feet similar colour to body surface. Tentacles yellow-brown. Coelomic wall with closely paired series of radial dark spots radially, spots scattered interradially, not associated with papillae or tube feet. An exceptionally large specimen (F120438) has extensive, brown, dorso-lateral patches, and papillae not conspicuously ocellate.

Distribution. Australia, Western Australia, Abrolhos Is (29°S), to Victoria, Portland (39°S, 141°E); southern continental slope, 97–800 m.

Etymology. From the Latin *austrinus* (southern) and *bassus* (deep), referring to the unusually high latitude and deep occurrence for the genus (feminine).

Remarks. The new species is assigned to *Holothuria* Linnaeus, 1767, and provisionally referred to the subgenus *Panningothuria* Rowe, 1969, as diagnosed in Rowe (1969). Rowe (1969) erected the monotypic sub-genus *Panningothuria* for *Holothuria forskali* Delle Chiaje, 1823, the principal diagnostic character being the sparse presence in the body wall of very reduced tables only. Molecular data (discussed below) indicate that *H. (Panningothuria) austrinabassa* sp. nov. and *H. (Panningothuria) forskali* are sister species. Fully developed tables are abundant in the body wall of *H. austrinabassa* sp. nov., but reduced tables, similar to those in *H. forskali*, are present in the tentacles. Both species lack buttons and rosettes in the body wall. Rowe (1969) also noted a collar of oral papillae in *H. forskali*. An inconspicuous irregular collar is evident only in the largest of the *H. austrinabassa* specimens. It is premature to either raise *Panningothuria* to generic status or create a synonymy (discussed below).

Types were not designated for *Holothuria forskali* Delle Chiaje, 1823, and the author of the species referred to the image of an undescribed species illustrated by Forsskål (1776). Koehler (1921) stated that the two characters that distinguish *H. forskali* amongst Mediterranean species are the very dark colour and presence of a cuvierian organ, although other

Mediterranean species also have a cuvierian organ. Koehler (1921) also noted the white papillae, although not all specimens of *H. forskali* have white papillae. All three characters are true of the specimen examined here and judged to be *H. forskali* (UM HO-1854).

H. austrinabassa resembles *H. forskali* in several morphological characters, such as: maximum length of 25 cm (*H. forskali* in Koehler, 1921); well-developed tuberculated papillae dorsally and laterally; collar of inconspicuous oral papillae; single dorsal stone canal and madreporite (pers. comm. for *H. forskali* by Giomar Helena Borrero Perez); tables the only ossicles in body wall; stout cuvierian tubules. VandenSpiegel et al. (1995) noted and illustrated three-dimensional, irregularly spherical, mesh-like, “bud-supporting ossicles” for *H. forskali*. Similar ossicles are present in the papilla apices of *H. austrinabassa*. Both species occur at exceptional depths for holothuriids. Perez-Ruzafa et al. (1987) reported *H. forskali* from the Mediterranean at depths of 0–193 m, and the Canary Is at a depth of 348 m. *H. austrinabassa* has been taken as deep as 800 m. Sequence data indicate significant separation of these sister species (discussed below). Significant morphological differences also are detailed in Table 2.

Table 3. Characters distinguishing *H. (Halodeima) nigralutea* O'Loughlin sp. nov. and *H. (Halodeima) edulis* Lesson

Characters	<i>H. nigralutea</i>	<i>H. edulis</i>
Colour	Discontinuous black over yellow	Dorsal black, ventral fuschia (red); or dorsal “grey”, ventral cream
Ventral black stripe	Present	Absent
Dark brown spots	Only at papillae and tube feet	Additional to papillae and tube feet
Depth	100 m, on continental slope	0–20 m (Rowe and Gates, 1995)

Table 4. Characters distinguishing *H. (Halodeima) signata* Ludwig and *H. (Halodeima) edulis* Lesson

Characters	<i>H. signata</i>	<i>H. edulis</i>
Colour	Grey brown with cream spots	Dorsal black, ventral fuschia (red); or dorsal “grey”, ventral cream
Length	Mostly 5–15 cm	Mostly 10–25 cm
Tables	Narrower spire (10–15 μ m at narrowest)	Broader spire (15–20 μ m at narrowest)
Rosettes	Mostly simple (mostly 2–5 perforations)	Simple to complex (2–15+ perforations)
Habit	Cryptic in reef during day	Exposed on sand during day

Table 5. Pairwise uncorrected p-distances among specimens of *H. edulis* complex

	1	2	3	4	5	6	7	8	9
1. <i>H. nigralutea</i> N120									
2. <i>H. nigralutea</i> G255	0.002								
3. <i>H. edulis</i> brown N3	0.028	0.028							
4. <i>H. edulis</i> typical J292	0.024	0.024	0.010						
5. <i>H. edulis</i> fuschia K140	0.013	0.011	0.023	0.016					
6. <i>H. edulis</i> typical G104	0.011	0.010	0.024	0.021	0.008				
7. <i>H. edulis</i> grey J282	0.015	0.013	0.024	0.018	0.005	0.010			
8. <i>H. edulis</i> grey J296	0.013	0.011	0.023	0.016	0.003	0.008	0.005		
9. <i>H. signata</i> G50	0.062	0.060	0.058	0.058	0.058	0.057	0.058	0.055	
10. <i>H. signata</i> G55	0.066	0.065	0.066	0.063	0.063	0.062	0.063	0.060	0.023



Figure 5. a, live paratype of *Holothuria* (*Halodeima*) *nigralutea* O'Loughlin sp. nov, from Western Australia, off Point Cloates (220 mm long; NMV F111290; photo by Karen Gowlett-Holmes). b, preserved holotype of *H. (Halodeima) nigralutea*, from Western Australia, off Point Cloates (148 mm long; upper dorsal, lower ventral; oral end right; NMV F120437; photos by David Staples). c, lectotype of *Holothuria edulis* Lesson, 1830 from Indonesia, Moluccan Is (160 mm long; MNHN EchH 543; upper dorsal, lower ventral; photos by Yves Samyn). d, live *H. (Halodeima) edulis*, from Japan, Okinawa (not collected, photo by Gustav Paulay). e, live *H. (Halodeima) edulis*, from northern Australia (not collected, photo by Neville Coleman). f, live atypical "grey" form of *H. (Halodeima) edulis*, from Japan, Okinawa (UF E3882, photo by Gustav Paulay).

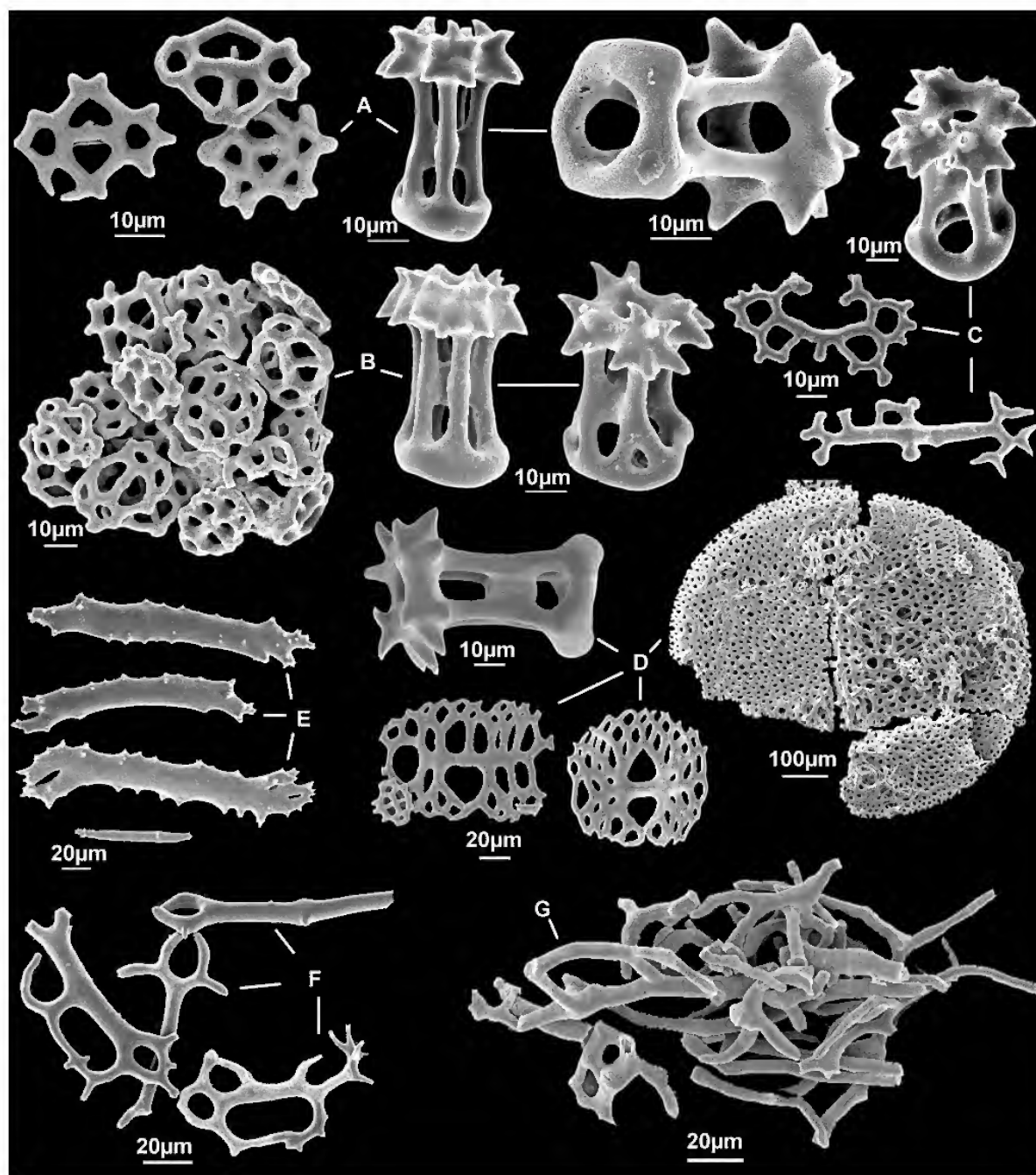


Figure 6. *Holothuria (Halodeima) nigrilutea* O'Loughlin sp. nov. (SEM of ossicles from NMV F111290). A, dorsal body wall; B, ventral body wall; C, anal body wall; D, tube feet; E, tentacles; F, respiratory trees; G, madreporite.

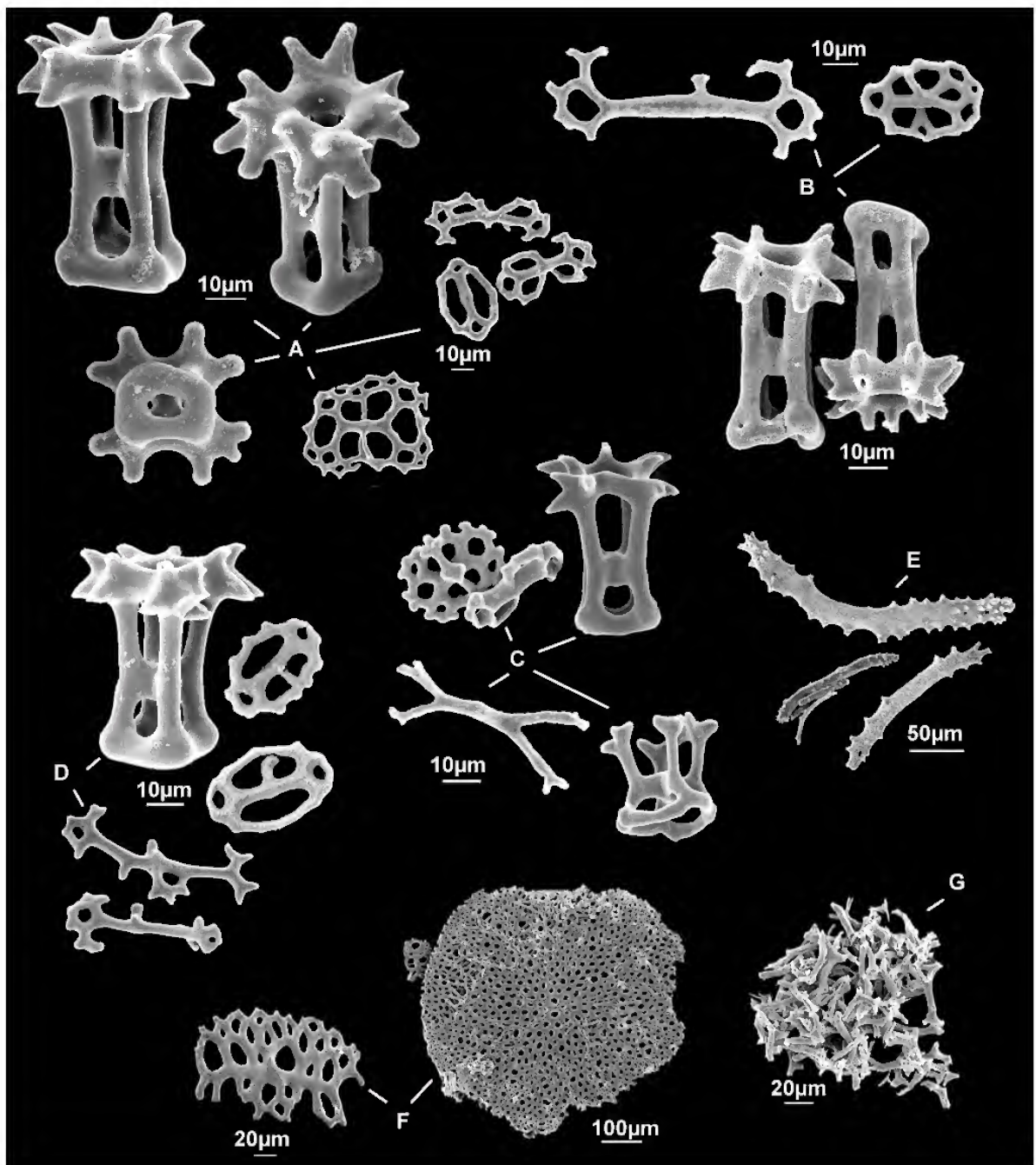


Figure 7. *Holothuria (Halodeima) edulis* Lesson, 1830 (SEM of ossicles from NMV F113599). A, dorsal body wall; B, anal body wall; C, oral body wall; D, ventral body wall; E, tentacles; F, tube feet; G, madreporite.

***Holothuria (Halodeima) nigralutea* O'Loughlin sp. nov.**

Figures 4–7, Tables 1, 3–5.

Material examined. Holotype: Western Australia, off Point Cloates, 22.86° S, 113.51° E, 100 m, *Southern Surveyor*, SS10/2005 stn 135, 9 Dec 2005, NMV F120437.

Paratypes: Type locality and date, F111290 (1); Dampier, 95–90 m, 19.79° S, 115.47° E, SS05/2007 stn 29, 12 Jun 2007, F146582 (1).

Comparative material examined. *H. (Halodeima) atra* Jäger, 1833. Fiji, F113579 (1); New Caledonia, Noumea, F95939 (1); N Australia, Gulf of Carpentaria, E Bremer I., F112194 (1).

H. (Halodeima) edulis Lesson, 1830. Lectotype, Indonesia, Moluccan Is., Lesson and Garnot, 1825, MNHN EcHh 543; N Australia, Gulf of Carpentaria, Bremer I., F95094 (1); Great Barrier Reef, Heron I., F95093 (1); F95095 (1); F113599 (1); Pacific Ocean, Wake Atoll, UF E4670.

Description (preserved specimens). Holotype 155 mm long, up to 35 mm high, up to 40 mm wide; paratype 145 mm long, up to 30 mm high, up to 45 mm wide; body length/width ratio less than 4; oval in transverse section, not tapering from mid-body, rounded anteriorly and posteriorly; live body form short, squat, narrow anterior neck, narrow posterior tail (see photo of paratype). Body wall thick, soft-leathery, 2–5 mm thick, wrinkled, surface smooth to slightly rugose. Mouth ventral, surrounded by an irregular collar of about 60 inconspicuous papillae. Tentacles 20, peltate, with long thin tubular ampullae extending off calcareous ring plates, subequal, up to 20 mm long. Anus terminal, lacking anal teeth, with few anal papillae dorsally, with paired anal tube feet ventrally. Dorsal and lateral papillae inconspicuous in size but conspicuous in colour, flat or nipple-like, about 0.5 mm diameter, scattered irregularly, 2–10 mm apart (holotype), lacking ampullae. Tube feet scattered irregularly over ventrum, 1–5 mm apart (holotype), retracted or slightly exposed, about 0.4 mm diameter, lacking ampullae. Left dorsolateral radial plate of calcareous ring 12 mm wide and 6 mm high, with 4 anterior points, posterior margin with shallow rounded indentation. Left dorso-lateral interradiat plate 4 mm high and wide, anterior margin with spire, posterior margin with rounded indentation. Tuft of small stone canals/madrepores on each side of dorsal mesentery, extending freely in coelom, up to 25 per tuft, each up to 3 mm long, some stone canals branched. Holotype with 4 sac-like polian vesicles, up to 5 mm long, 1 branched; paratype with 4 tubular, thin, polian vesicles, 3, 8, 10, 25 mm long, 2 branched from common base. Longitudinal muscles flat, broadly attached, with narrowly free edges, up to 5 mm wide dorsally, up to 15 mm wide ventrally. Gonad tubules long, thin, multiple branching, extending half of body length. Respiratory trees extending to anterior end. Cuvierian organ absent. Gut contents calcareous detritus, with fragments up to 6 mm long.

Ossicles. Dorsal body wall with numerous rosettes, few tables; tables variable in form and size, 48–64 μ m, commonly 56 μ m long; disc reduced, typically 28 μ m wide, smooth with a single central perforation; spire typically 20 μ m wide, with 4 pillars united by a single cross-beam; crown widely spinous, typically 40 μ m wide, with 16–20 large spines; rosettes plate-like, variable in form, with obtusely angular branches arising from primary rod, 24–48 μ m long, frequently 2 small

terminal and 2 large, lateral perforations (frequently with transverse bridging connection), but with up to 8 perforations. Papillae with rods, some mesh-like ossicles; rods up to 160 μ m long, variably bluntly spinous, curved, with some distal perforations; papilla apex with irregular small rods resembling those in madreporite, some anastomosing to form an irregular open mesh. Ventral body wall with numerous rosettes, fewer tables; tables same as dorsal; rosettes larger than dorsally, up to 10 perforations, up to 40 μ m long. Tube feet with endplates, perforated plates, tables, rosettes; endplates multilayered, up to 480 μ m wide; perforated plates smooth, thin, subrectangular, formed from primary rod with perpendicular lateral branches, up to 128x104 μ m, typically with 2 large lateral perforations mid-rod; tables and rosettes as in ventral body wall. Oral body wall with rosettes, tables, rods; tables similar to dorsal; rosettes frequently larger than dorsal ones, up to 56 μ m long; rods same as in tentacles, up to 184 μ m long. Anal body wall with rosettes, few tables, some rods; tables and rosettes as in ventral body wall; rods frequently with lateral branches, branches frequently joined to form lateral and terminal perforations, rods up to 88 μ m long, intergrade with rosettes. Tentacle rods up to 344 μ m long, frequently curved, thick to thin, coarsely or finely spinous, spines close or sparse, rare branches, with rare, mostly terminal perforations. Stone canal/madreporite ossicles massed irregular rods, some branched, some anastomosing to create perforations, some with an irregular, perforated mesh, up to 134 μ m long. Respiratory tree with numerous irregular rods, up to 160 μ m long, frequently with small node in middle of rod, and with branches at ends and node, variable in length and form, some branches joined to create terminal or lateral perforations.

Ossicles absent from tentacle ampullae, polian vesicles, gonad tubules, longitudinal muscles, circular muscles, and wall of cloaca.

Colour. Live colour (paratype): black on pale yellow; with scattered, small, brown spots at papillae. Preserved colour: variable pattern of black over pale yellow; with small red-brown spots around papillae and tube feet, spots irregularly distributed all over body, such spots always associated with papillae or tube feet; interior body wall with scattered, superficial, irregular black spots, that are not associated with papillae or tube feet.

Distribution. Off Point Cloates, Western Australia; 100 m.

Etymology. From the Latin *niger* (black) and *luteus* (yellow), referring to the black and yellow live colour (feminine).

Remarks. This species is assigned to *Holothuria* Linnaeus, 1767, and provisionally referred to the subgenus *Halodeima* Pearson, 1914, as diagnosed in Rowe (1969). Samyn et al. (2005) suggested that *Halodeima* might need to be raised to generic rank, but added that “revision of Holothuriidae will depend on further comparative taxonomic studies as well as on more detailed phylogenetic analyses before any of the changes proposed can be solidified into a new classification”. This work is progressing, and it remains premature to raise *Halodeima* to generic status or erect a new genus (see below).

The type species of *Halodeima* Pearson, 1914 is *Holothuria atra* Jäger, 1833 (by original designation). Rowe (1969) considered the following species to constitute *Halodeima*: *H. chilensis* Semper, 1868; *H. edulis* Lesson, 1830; *H. floridana* Pourtalés, 1851; *H. grisea* Selenka, 1867; *Stichopus kefersteini* Selenka, 1867; *H. mexicana* Ludwig, 1875; *H. pulla* Selenka, 1867; *Halodeima stocki* Cherbonnier, 1964. Pawson (1978) added *H. manningi*. Samyn (2003), Pawson (1995) and Paulay (1989, 2003) also listed *H. signata* Ludwig, 1875 as a valid species of *Halodeima*.

Molecular data indicate that *H. (Halodeima) nigralutea* is most closely related to *H. (Halodeima) edulis* Lesson (see below), and the morphology of these species is closely similar. Distinguishing characters are listed in Table 3. In describing his new species Lesson (1830) referred principally to its widespread commercial use, but he noted: cylindrical rounded

thin slightly rugose sinuous form; ventral cover of irregularly distributed papillae; upper body deep sooty black colour; under body and sides pleasant red colour, speckled with black spots. Cherbonnier (1951) gave a more detailed description and illustrated the ossicles of the lectotype of *H. edulis*. He noted it had 6 polian vesicles, ranging in size from large to very small. The specimens of *H. edulis* examined in this study are in accord with these features. Féral and Cherbonnier (1986) illustrated live colour (p. 82 only).

Both specimens of *H. nigralutea* have ossicles in the respiratory trees. No ossicles were encountered in the respiratory tree of the lectotype of *H. edulis*. Ossicles were noted in only 1 of 7 specimens of *H. edulis* from northern Australia (NMV F95095), as they were in a specimen from Wake Atoll (UF E4670) (GP). Presence or absence of respiratory tree ossicles in *H. edulis* appears to be a variable character.



Figure 8. a, preserved lectotype of *Holothuria signata* Ludwig, 1875 from Tahiti, French Polynesia (100 mm long in Ludwig, 1875; UH E2638; photo by Peter Stiewe). b, live *H. (Halodeima) signata*, from Moorea, French Polynesia (UF E4986; photo by Gustav Paulay). c, close-up of preserved lectotype of *H. signata* (UH E2638). d, close-up of live *H. (Halodeima) signata* (UF E4986).

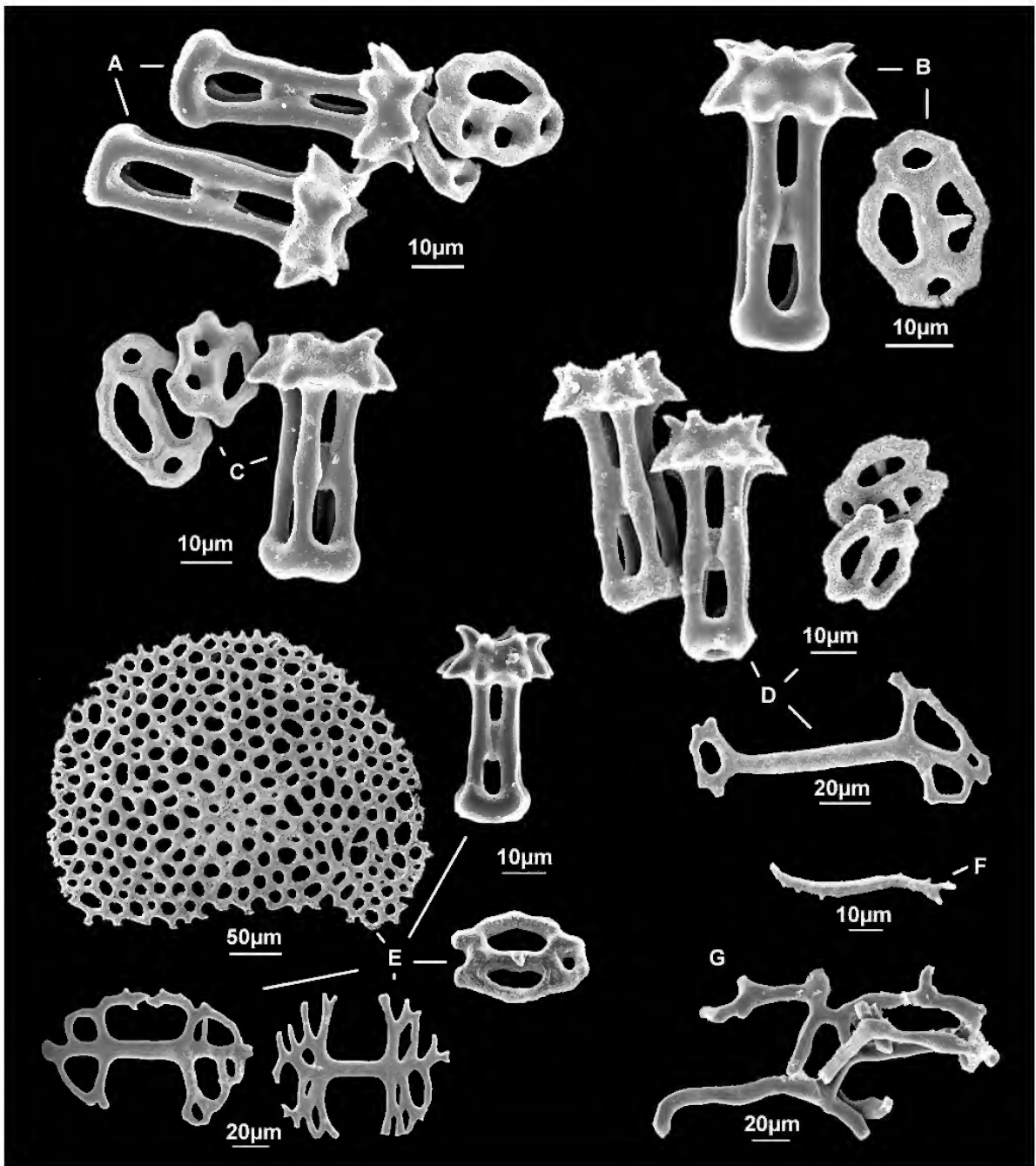


Figure 9. *Holothuria (Halodeima) signata* Ludwig, 1875 (SEM of ossicles from UF 173). A, dorsal body wall; B, ventral body wall; C, anal body wall; D, papillae; E, tube feet; F, tentacles; G, madreporite.

Holothuria (Halodeima) signata Ludwig, 1875

Figures 4, 8, 9, Tables 1, 4, 5.

Holothuria signata Ludwig, 1875: 99, pl. V7, fig. 36.—Lampert, 1885: 64.—Théel, 1886: 222–223.—Ludwig, 1889–92: 330.—Lampert, 1896: 53.—Ekman, 1926: 438, fig. D1.

Holothuria edulis.—Ludwig, 1899: 559–560.—Domantay, 1933: 63 (part, *H. signata* treated as a junior synonym of *H. edulis*).

Holothuria (Halodeima) signata.—Paulay, 1989: 10, 27.—Paulay, 2003: 577.—Pawson, 1995: 188.—Samyn 2003: 35.

Holothuria sp. (?) *signata*.—Erhardt and Baensch, 1998: 1088.

Material examined. Lectotype (UH E2638 here designated): Pacific Ocean, Tahiti, UH E2638.

Other material. Mariana Is, Guam I., Asan, reef slope, in crevice on sand, night, 22 Jul 1992, RBINS IG30817; Orote Peninsula, south side, under rubble, 15–25 m, 22 Aug 1994, UF E173; Piti Bombholes, reef flat, moat, or lagoon, 5–10 m, 19 Jul 2003, UF E4713; Saipan I., outside Managaha Survey Site, forereef, under rubble, 8–12 m, 5 Jan 2003, UF E3447; Tinian I., Unai Babui, forereef, under rocks on sand, 15 m, 12 May 2005, UF E4640.

Niue I., off Alofi wharf, outer reef slope, on reef rock, 14 m, 20 May 1986, UF E1333; Namukulu, Limu Reef flat, pools, undersides of rocks, 0–5 m, 7 Oct 1991, UF E1406; reef flat at Tuapa, <10 m from shore, 27 Aug 1986, UF E1886; off Alofi wharf, outer reef slope, 12–15 m, 9 Mar 1986, UF E1663.

Cook Is, Rarotonga I., Nikao, outer fringing reef, exposed in shallow pools, 20 May 1984, USNM E37966; Mauke I., Taunganui Harbor, 15–20 m, 3 Dec 1984, USNM E37968; Mauke I., Taunganui Harbor, 12 Dec 1984, UF E1831.

Society Is, Tahiti I., Tautira, in coral rubble zone, under dead coral blocks, 0.5–1.5 m, 3 Sep 1984, UF E4999; Moorea I., NE corner of Moorea, Aroa, 200–300 m E of channel, 6–15 m, 7 May 2006, UF E5015; Moorea I., barrier reef between Cook's and Opunohu Bays (Vaipahu), outer part of barrier reef, within 1–60 m of reef crest, 0–2 m, 3 Jul 2006, UF E4986.

Tuamotu Is, Rangiroa Atoll, off Hotua Ura Motu, ca. 1 km W. of Avatoru Pass, outer reef slope, under rocks, 15–21 m, 10 Oct 2001, UF E325; Rangiroa Atoll, ca. 1 km S of NW point of atoll, off Motu Maeherehona, outer reef slope, under rocks, 6–12 m, 10 Nov 2001, UF E329; Rangiroa Atoll, ca. 2 km S of NW point of atoll, at southernmost storm lock zone, off Motu Maeherehona, outer reef slope, exposed, 3–12 m, 26 Oct 2001, UF E591.

Pitcairn Is, Henderson I., outer reef slope off North Beach, 15 m, 17 May 1987, USNM E50251; outer reef slope off Northwest Beach, 10–14 m, 15 May 1987, USNM E50252; Oeno Atoll, lagoon near south shore of main island, 2.5 m, 28 May 1987, USNM E50253; Pitcairn I., 8–20 m, May 1987, USNM E50254.

Description (anatomy based on UF E173 only). Cylindrical, >5 times as long as wide (14.5 cm x 2.5 cm in UF E173), with rounded anterior and posterior; anus terminal, mouth ventral; body wall smooth, with velvety texture provided by dense layer of table crowns arranged right beneath the surface, 0.5–2 mm thick, thicker dorsally than ventrally. Interior of body wall off-white, with conspicuous, large, scattered, black spots that do not positionally correspond to location of tube feet. Ventral and dorsal tube feet in rough rows, but spread out, all small, not elevated on tubercles. Pedicels with well developed terminal disc; dorsal tube feet also with terminal discs, but narrow, reduced. 2 stone canals and madreporites on left side, 4 on right side; single, ampulliform, 11 mm long, polian vesicle ventrally. Gonad on left side. Ring canal 9 mm posterior to calcareous

ring. 18–21 peltate oral tentacles (UF E173 - 21, UF E325 - 18). No specialized perianal tube feet. No cuvierian tubules. Longitudinal muscles narrow, bifid, attached only medially, with broad free margins.

Dorsal body wall with abundant tables and sparser rosettes. Tables with well developed crown of maltese cross with double ring of 8 spines typical of species group; spire elongate, comprised of 4 pillars joined at ends and by mid-level cross beam; base of table with smooth knob, lacking disk. Tables 1.75+/-0.10 times as long as wide, 51.5+/-2.3 μ m (N=10, range: 47.5–55 μ m) long, 29.5+/-2.7 μ m (N=10, range: 25–35 μ m) in diameter (at crown). Rosettes usually simple, with two parallel perforations, one of these subdivided in some, with 1 or 2 additional, terminal perforations developed in some, rarely more complex. Respiratory tree with abundant, thin, spiny rods. Longitudinal muscles, circular muscles, polian vesicles, and tentacle ampullae without ossicles.

Colour. In life: greyish-brown, somewhat lighter ventrally than dorsally; with small, round, cream to light tan spots surrounding each pedicel and papilla, both dorsally and ventrally. Tentacles yellowish to cream. Pedicels light tan basally, like the spot from which they arise, rapidly darkening to black-brown terminally, but with light tan terminal disc. Papillae same.

Distribution. Oceania, at least from the Mariana Is and Niue I. in the west, to the Pitcairn Is in the east (Paulay, 1989, 2003, herein).

Remarks. *Holothuria signata* was relegated into the synonymy of *H. edulis* soon after its description. Ludwig himself later (1899) considered his species synonymous with *H. edulis*, based in part on Lampert's (1896) suggestion that they may be conspecific. Most literature records subsequent to the original description (such as Lampert, 1896) are secondary citations, or records of specimens that, on the basis of their description, are referable to *Holothuria edulis*. The only records of additional specimens of *H. signata* are Paulay's (1989, 2003) records from the Pitcairn and Mariana Is, although little information was provided in those papers, and Erhardt and Baensch's (1998) record.

During the preparation of this paper, we re-examined the description and, remotely, the type specimen of *H. signata* and were able to confirm its identity, as well as its distinctiveness from *H. edulis*. Ludwig (1875) clearly describes the unusual and unique colour pattern of this species, a pattern that, albeit faded, is still discernible in the lectotype today. Ludwig also illustrates the body wall tables, which are distinctly narrower than those of *H. edulis*. Finally, the identity of the species is also suggested on biogeographical grounds. Only two species of *Holothuria (Halodeima)* are known from French Polynesia, the type locality of *H. signata*: *H. signata* and the quite different *H. atra*. As far as we know *H. edulis* does not reach this area. One of us (GP) has studied the holothurians of French Polynesia on several occasions over the past 25 years, including a 2-month survey in 2006 of Moorea I. (just 17 km from Tahiti), and has never seen *H. edulis* in the area. In contrast *H. signata* is fairly common there.

Holothuria signata is a relatively small species that conceals itself during the day within the reef matrix (including under rocks), emerging at night to feed on the reef surface. Its

habit thus contrasts markedly with that of *H. edulis*, a day-active, exposed animal that prefers pockets of soft sediments within the reef, often in a lagoonal setting. The 2 species are immediately distinguishable on colour pattern, the shape of table ossicles, as well as genetically. *Holothuria signata* also does not grow as large as *H. edulis*.

Discussion

The discovery of these two new holothuriid species is noteworthy for several reasons. It shows that holothuriids are better represented at moderately high latitudes and in deep water than heretofore suspected. Rowe and Gates (1995) reported numerous holothuriid species in the Tasman Sea as far south as Lord Howe I. (32°S), *Holothuria integra* Koehler and Vaney as far south on the east coast of Australia as Botany Bay (34°S), *Actinopyga echinites* (Jaeger) and *H. atra* Jäger as far south on the west coast of Australia as Fremantle (32°S), and *H. hartmeyer* Erwe as far south as Port Lincoln on the South Australia coast (35°S). Ludwig (1898) (see also Samyn and Massin, 2003 for a redescription) described *H. platei* from the Juan Fernandez Is (33°S). Marsh and Pawson (1993) reported *H. cinerascens* (Brandt), *H. arenicola* Semper and *H. macroporona* H.L. Clark from Western Australia, Rottnest I. (32°S). Similarly on the east coast of Africa several holothuriids have been reported at high latitudes. For instance Deichmann (1948) reported *H. parva* from Port Edward (31°S) and *H. cinerascens* from Umtwalumi (31°S). Samyn (2003, dataset as annex in Samyn and Tallon, 2005) gives accurate distribution maps of the species reported in the Western Indian Ocean. *H. austrinabassa* occurs as far as 39°S. Rowe and Gates (1995) reported the deepest occurrence of a holothuriid in Australasian waters as *H. uncia* Rowe at Norfolk I. in the Tasman Sea at 342–360 m. *H. austrinabassa* occurs to a depth of 800 m.

Ongoing investigation into the phylogenetic relationships of holothuriid sea cucumbers (Paulay and others, unpublished), now covering more than 100 species in the family, identifies *H. (Panningothuria) forskali* as the closest sequenced relative of *H. (Panningothuria) austrinabassa*, and *H. (Halodeima) edulis* as the closest sequenced relative of *H. (Halodeima) nigralutea*. Both relationships are well supported (100/1.0 parsimony bootstrap and Bayesian posterior probability). The evolutionary origins of the two new species described here are markedly different: *H. austrinabassa* represents an old lineage, the only other known member of which is the northernmost holothuriid *H. forskali*. In contrast, *H. nigralutea* is a very recent offshoot of the shallow, tropical *H. edulis* complex.

Holothuria forskali, the type and only species of *Holothuria (Panningothuria)* Rowe, 1969, and *H. austrinabassa*, together form an isolated, deep branch in the family, suggesting that *Panningothuria* may warrant generic recognition. However, additional sampling and analysis are necessary to resolve the deep branching order in the Holothuriidae, before we are prepared to revise the genus level classification of the family. The two species differ at 13% of base pairs in the sequenced portion of 16S-COI, a level of differentiation typical of widely divergent sister species in this family. The

relationship of these two species is intriguing, as they are the northernmost and southernmost species of Holothuriidae, demonstrating extreme temperate, cool water invasion, and bipolar distribution and dispersal. Holothuriids are predominantly tropical, shallow water forms, and only a handful of species invade warm temperate environments. *Holothuria forskali* reaches by far the highest latitude among holothuriids, extending to at least 57°N (Global Biodiversity Information Facility <gbif.org>) in the northeast Atlantic. *Holothuria austrinabassa* is known south to 39°S. It is also unusual in occupying the only known deep, cold water habitat. It thus represents the southernmost, and most cold-tolerant southern hemisphere holothuriid.

Additional morphological and genetic work is needed to resolve whether *Halodeima* is monophyletic. Our preliminary work indicates that *Halodeima* clusters with the subgenera *Vaneyothuria*, *Holothuria*, *Selenkothuria*, *Semperothuria*, and some *Thymiosycia*. Three well supported clades of *Halodeima* are recognizable based on sequence data: *H. atra*, *H. mexicana-floridana-grisea-kefersteini*, and *H. signata-edulis-nigralutea* (fig. 4). In addition to their unusual ossicle complement (reduced discs on tables, and rosettes), most investigated *Halodeima* spp. (*nigralutea*, *edulis*, *atra*, *signata*, *floridana* (Edwards, 1908, with illustration), and *mexicana* (Hyman, 1955, with illustration)) have multiple madreporites, providing further morphological evidence of their potential relationships. On the other hand, the tables in the *H. signata-edulis-nigralutea* clade have a single central disc perforation, while the tables in *H. atra* (see Rowe, 1969) and *H. floridana-grisea-mexicana* (see Hendler et al., 1995) have additional disc perforations.

H. (Halodeima) nigralutea is morphologically and genetically closest to *H. (Halodeima) edulis*. Species in the clade *signata-edulis-nigralutea* are very similar genetically, as well as morphologically, with maximum 16S-COI sequence divergence of 5.5–6.5 % between the basal *H. signata* and other forms (Table 5). While *H. signata* is clearly differentiated, specimens assigned to *H. edulis* and *H. nigralutea* show very limited divergence and a more complex pattern (fig. 4). Thus three forms are reciprocally monophyletic based on the sequence data on hand: *H. edulis* from the Pacific basin (Philippines, Okinawa, Guam), *H. edulis* from the Indian Ocean (J292, N3, Oman and Cocos Keeling), and *H. nigralutea*, with *H. nigralutea* sister to the Pacific *edulis* clade. Thus this species complex appears to have undergone rapid, recent differentiation into three forms: *H. edulis* in the Western Pacific, *H. edulis* in the Indian Ocean, and *H. nigralutea*. While Pacific and Indian Ocean populations of *H. edulis* look similar, *H. nigralutea* has a distinct colour pattern and also differs in other details (see above). Similar rapid speciation has also been documented within the teatfish complex *Holothuria (Microthele)* by Uthicke et al. (2004).

Several colour variants are represented among the sequenced *H. edulis* specimens. G104 and J292 represent typical forms, with a dark dorsum and a fuschia venter. K140 is a specimen that is uniformly fuschia, without the dark dorsum. Although no live colour information is available for it, N3 is represented by a specimen that has a distinctive colour

in pickle: brown both dorsally and ventrally, and tan laterally. While the above represent rare colour variants, a fairly common colour form often assigned to *H. edulis* was also sequenced. This grey form (J282, J296; fig. 5f), also illustrated in Féral and Cherbonnier (1986), is known to us from New Caledonia (Féral and Cherbonnier, 1986), Okinawa and Mauke (Cook Is) (GP), and Nauru (Alex Kerr, pers. comm.). It differs from typical *H. edulis* in its greyer colour, lacking the fuschia pattern of the latter, dark transverse creases, and habit of hiding in the reef matrix during the day (at least in Okinawa, Mauke, and New Caledonia (P. Laboute, pers. comm.)). Although we expected this form to represent a distinct species, there are no fixed nucleotide differences discernible within the sequenced 16S-COI region, between it and typical Western Pacific *H. edulis*. Determining the status of this form will require further work, but it may be an ecomorph of *H. edulis*. Potentially the fuschia colour present in typical *H. edulis* could be due to a UV-photo-protective pigment that may be restricted to animals that live exposed to the sun, and is not developed in individuals living in cryptic habitats. The other colour morphs mentioned above were also genetically undifferentiated from typically-coloured individuals of *H. edulis* (fig. 4).

The contrasting evolutionary histories of these two high-latitude holothurians in Australia have close parallels in other invertebrates, most notably in cypraeid gastropods (cowries) (Meyer, 2003). Southern and western Australia are home to a large number of endemics, including endemic cowries. These include radiations of *Umbilia*, *Zoila*, and *Notocypraea*; all old, divergent cowrie genera that must have evolved the ability to live at high latitudes some time ago. The last is sister to *Cypraeovula*, a temperate genus in South Africa, showing biogeographic disjunction within the temperate zone. Extinct Japanese *Zoila* indicate this genus had a bipolar distribution in the past. In contrast the cowrie genus *Cribarula* has given rise to a series of subtropical western Australian endemic forms rapidly and in succession, much like the origin of *H. nigralutea*.

These and other invertebrates show that tropical species can rapidly give rise to western Australian subtropical and temperate endemics, but also that other cool-water elements of this region have specialized to high latitudes a long time ago.

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New apodid species from southern Australia (Echinodermata: Holothuroidea: Apodida)

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Abstract

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A new chiridotid genus is erected: *Archedota* O'Loughlin gen. nov. In addition, seven apodid species, new to science, are described (O'Loughlin as author) for the rocky shallows, continental shelf and continental slope of southern Australia: chiridotids *Archedota lapidea*, *Taeniogyrus papillis*, *Taeniogyrus tantulus*, *Trochodota epiphyka*; myriotrochids *Prototrochus burni*, *Prototrochus staplesi*, *Prototrochus taniae*. *Taeniogyrus heterosigmus* Heding, *Taeniogyrus roebucki* (Joshua), *Trochodota allani* (Joshua) and *Trochodota shepherdii* Rowe are discussed. Keys are provided for southern Australian species of *Taeniogyrus* Semper and *Trochodota* Ludwig. A table is provided distinguishing Tasman Sea myriotrochid species.

Keywords

Echinodermata, Holothuroidea, Apodida, Chiridotidae, Myriotrochidae, new genus, new species, taxonomy, keys

Introduction

H. L. Clark (1946), A. M. Clark and Rowe (1971), and Rowe (1995) summarized an incomplete knowledge of the Australian apodid fauna. These apodids fall broadly into two groups: tropical fauna in the north, with species of *Chiridota* Eschscholtz, *Polycheira* H.L. Clark, *Scoliorhapis* H.L. Clark, *Taeniogyrus* Semper, *Trochodota* Ludwig, *Euapta* Östergren, *Leptosynapta* Verrill, *Ophedoesoma* Fisher, *Polyplectana* H.L. Clark, *Protankyra* Östergren, *Rynkatorpa* Rowe and Pawson, *Synapta* Eschscholtz, *Synaptula* Örsted; temperate fauna across the southern Australian coast, with the nine species *Chiridota gigas* Dendy and Hindle, *Scoliorhapis theeli* (Heding), *Taeniogyrus cidaridis* Ohshima, *Taeniogyrus heterosigmus* Heding, *Taeniogyrus roebucki* (Joshua), *Trochodota allani* (Joshua), *Trochodota shepherdii* Rowe, *Leptosynapta dolabrifera* (Stimpson), *Rynkatorpa hickmani* Rowe and Pawson. The record of *Taeniogyrus cidaridis* Ohshima (type locality Japan) for southern Australia is based on a single specimen taken off Rottnest I. near Perth in Western Australia in 1931. H.L. Clark (1946) doubted the reliability of this determination. Australian museums hold many specimens of undescribed apodid species from tropical and temperate waters. The focus of this paper is a selection of some chiridotid material from the rocky shallows and off-shore sediments of southern Australia, and the first reported myriotrochid material from the eastern continental slope of Australia.

Material and methods

Material examined here is principally in the Museum Victoria collection, with single specimens examined from the Western Australian Museum and Zoological Museum in Hamburg. Mark O'Loughlin is the author of the new taxa and systematic comments. For scanning electron microscope (SEM), ossicles were cleared of associated soft tissues in commercial bleach. They were then air-dried, mounted on aluminium stubs, and coated with gold. Observations were done by Didier VandenSpiegel using a JEOL JSM-6480LV SEM, and Tania Bardsley and Phil Bock using a Philips XL20 SEM. SEM measurements were made on large myriotrochid wheel ossicles by Didier VandenSpiegel with Smile view software. Four measurements were taken on each wheel: h = hub diameter, s = spoke length, t = tooth length, w = wheel diameter (see fig. 10d). Photographs of the smallest type specimens were taken by Chris Rowley using a Leica MZ16 stereomicroscope, Leica DC500 digital camera, and "Auto-Montage" software for composition of images. Compound microscope photos were taken by Mark O'Loughlin using an Olympus BX50 compound microscope and Nikon D70 digital camera.

Abbreviations: NMV—Museum Victoria, registration number prefix F; WAM—Western Australian Museum, prefix Z; ZMH—Zoologisches Museum für Hamburg, prefix E.

Throughout this paper Rowe (in Rowe and Gates, 1995) is referred to as Rowe (1995), Dr. Frank W. E. Rowe being the systematic authority in that work.

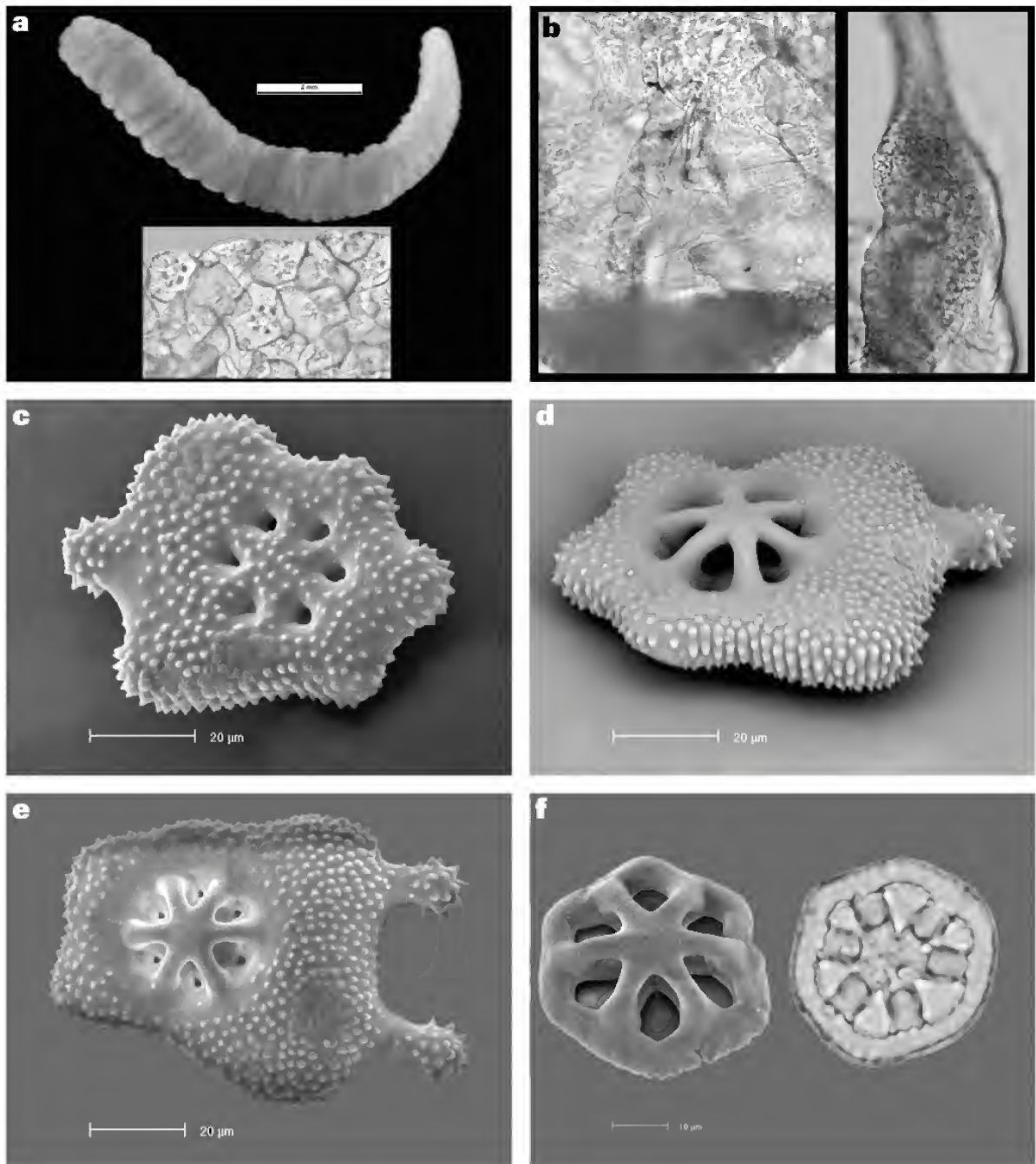


Figure 1. *Archedota lapidea* O'Loughlin sp. nov. from Bass Strait. a, holotype NMV F59193, body wall ossicles in situ (insert). b (left), 2 tentacles (vertical) with contracted digits evident left, and smooth rods at top (paratype F59194); b (right), fused plates of calcareous ring, radial plate (below) with anterior indentation (left), interrarial plate with anterior and posterior concave indentations (above) (paratype F59194). c–e, spinous wheel-hub plates from body wall, with complex hubs and lateral projections (holotype F59193; SEM by Tania Bardsley and Phil Bock). f, rare wheels from body wall, with complex hub and continuous teeth on inner rim (holotype SEM image left, paratype optical image right).

Order **Apodida** Brandt, 1835 (sensu Östergren, 1907)

Suborder **ynaptina** Smirnov, 1998

Diagnosis (Smirnov, 1998). Plates of calcareous ring without prominent anterior projections; excavations for tentacular ampullae lie on outer side of calcareous ring. Madreporite situated far from water ring at end of long stone canal. Ciliated funnels present. One to many polian vesicles. Body wall ossicles may be wheels of chiridotid type with 6 spokes and a complex hub and/or sigmoid hooks, or anchors and anchor plates. Wheels of larvae and juveniles with more spokes and small denticles on inner side of rim.

Chiridotidae Östergren, 1898

Diagnosis (Smirnov, 1998). Synaptina with 10, 12 or 18 peltatodigitate, pinnate or bifurcate tentacles. Juveniles with bifurcate tentacles. Body wall ossicles wheels of chiridotid type and/or sigmoid hooks. Chiridotid type wheels with 6 spokes, numerous small denticles on inner side of rim and a complex hub; on lower side of each spoke a branch leans against the lower end of the hub forming a star structure. Ossicles in tentacles usually rods with branched ends.

Subfamily **Taeniogyrinae** Smirnov, 1998

Diagnosis (Smirnov, 1998). Chiridotidae with 10 or 12 tentacles. Body wall ossicles wheels of chiridotid type and sigmoid hooks or sigmoid hooks only. Radial plates of calcareous ring not perforated but sometimes slightly notched in anterior (upper) face for passage of nerves.

Remarks. The characters of the new genus below accord best with the subfamily Taeniogyrinae, but exceptional characters of the new genus are an absence of sigmoid hooks, and presence of spinous plates with wheel-spoked perforations. Smirnov (1998) included in his new subfamily Taeniogyrinae the genera

to which new species are assigned below: *Taeniogyrus* Semper, 1868 and *Trochodota* Ludwig, 1892.

Archedota O'Loughlin gen. nov.

Figure 1

Diagnosis. Taeniogyrid genus with body wall ossicles irregular thick spinous plates with wheel-spoked perforations with complex hubs, and rare chiridotid wheels; lacking sigmoid hooks.

Type species. *Archedota lapidea* O'Loughlin sp. nov. (below; monotypic)

Distribution. Australia, Victoria, western Bass Strait, 39°S 143°E, 92–85 m.

Etymology. From the Greek *arche* (old, beginning), referring to the apparently primitive form of the wheel-spoked perforated plates, with *dota* from the family name Chiridotidae (feminine).

Remarks. The characters of this new apodid genus *Archedota* O'Loughlin gen. nov. are in accord with the above diagnoses of suborder, family and subfamily, with the exception of the presence of spinous plates with wheel-spoked perforations. This significant diagnostic character difference supports the erection of new higher taxa (suborder, family, subfamily), but on the basis of having only 2 specimens, and in the absence of molecular genetic data, I am limiting my response to the erection of a new genus only. *Archedota lapidea* O'Loughlin sp. nov. (below) differs only in ossicle form from the other genera of Chiridotidae. The presence of wheel-spoked single perforations in thick, closely spinous plates is a unique character amongst the chiridotids. Rare chiridotid-type wheels are present amongst the abundant, massed, perforated wheel-spoked plates. Absence of sigmoid hooks is also exceptional within the diagnosis of Taeniogyrinae. I acknowledge that in subjectively describing (etymology) the plate ossicles as “primitive”, and perhaps precursors to wheel ossicles, the form of the plates may in fact indicate a regressive condition or wheel ossicles with secondary developments.

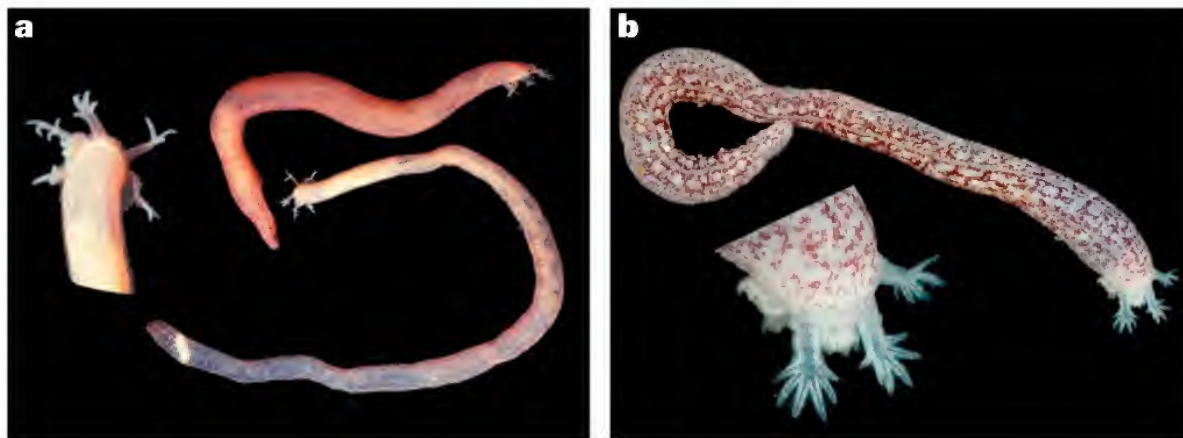


Figure 2. Photos of live taeniogyrid specimens. a, *Taeniogyrus roebucki* (Joshua, 1914) from Flinders rocky shallows, with 2 pairs of digits per tentacle (NMV F73591; photo by Ian Kirwan). b, *Trochodota epiphyka* O'Loughlin sp. nov. from Cape Bridgewater rocky shallows, with 3 pairs of digits per tentacle (F125372; 32 mm long live; photo by Leon Altoff and Audrey Falconer).

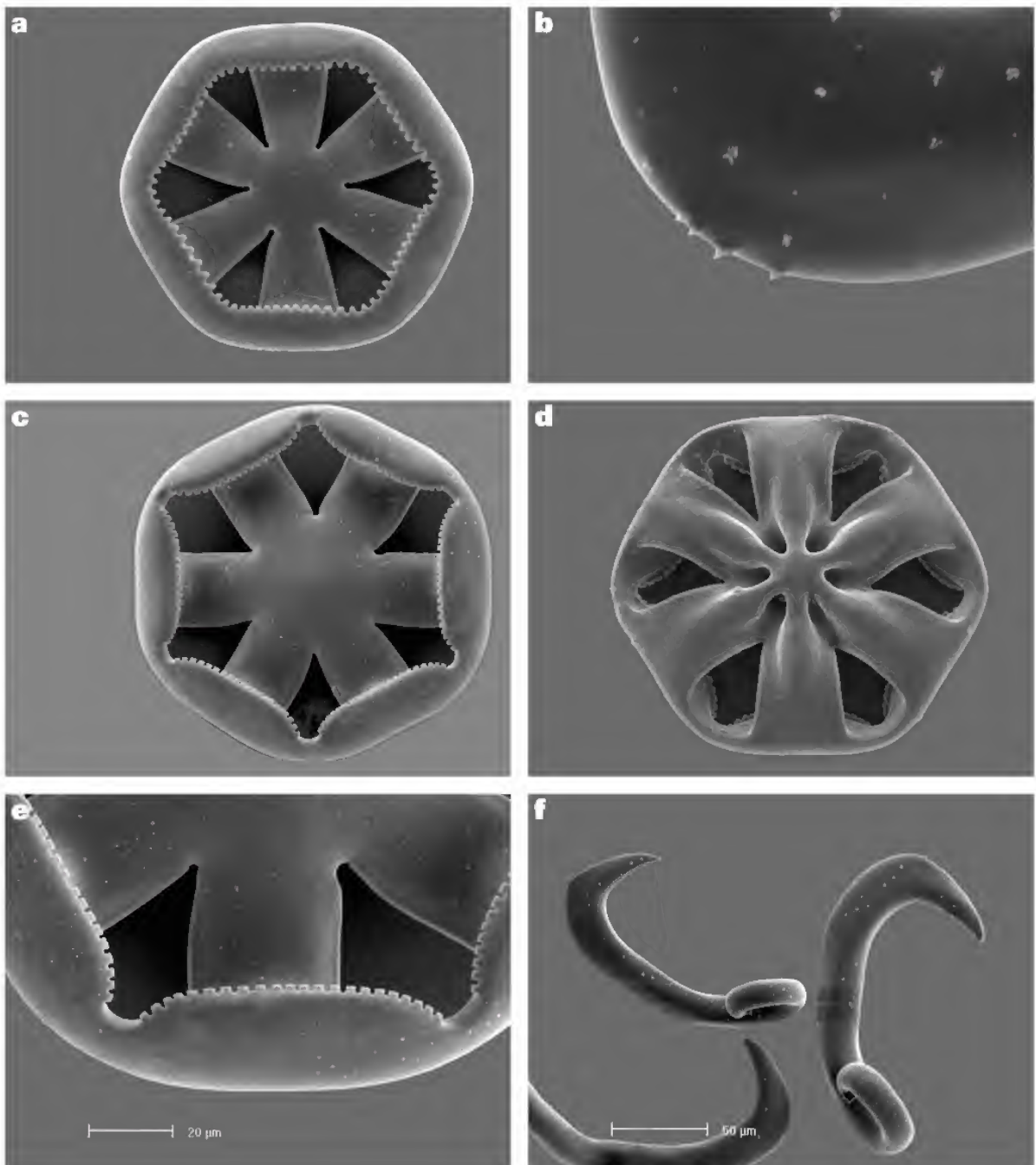


Figure 3. Body wall ossicles of specimens of *Taeniogyrus* Semper, 1868 and *Trochodota* Ludwig, 1891 (SEM by Tania Bardsley and Phil Bock). a, b, *Taeniogyrus roebucki* (Joshua, 1914), NMV F82716: a, wheel with continuous series of teeth on inner rim; b, outer curved edge of hook with minute spinelets. c–f, *Trochodota allani* (Joshua, 1912), F82705: c–e, wheels with discontinuous series of teeth on inner rim, and complex hub; f, sigmoid hooks with minute spinelets on outer curved edge.

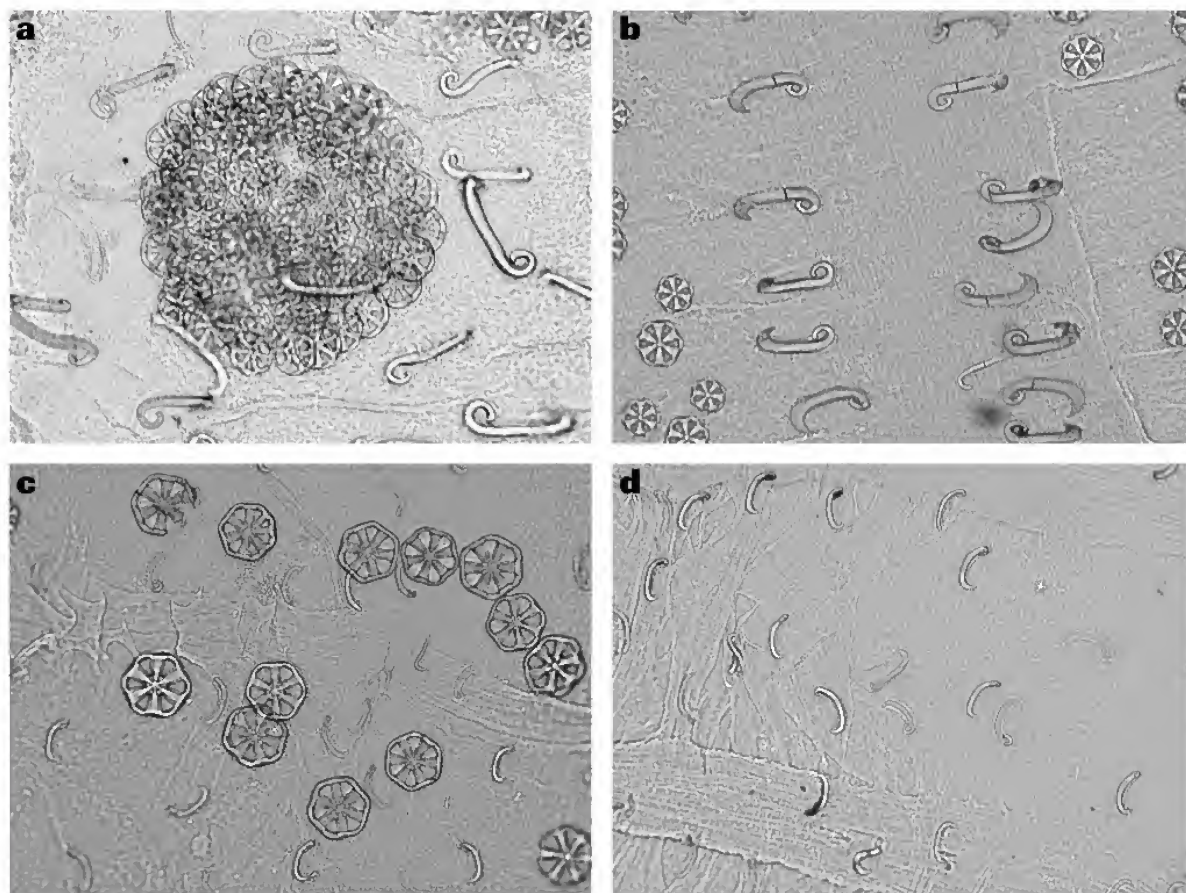


Figure 4. Body wall ossicles in body mounts from *Taeniogyrus* Semper species. a, dense wheel clusters and large hooks in *Taeniogyrus heterosigmus* Hedging, 1931, NMV F82707; b, parallel rows of large hooks along edges of longitudinal muscles in body wall of *Taeniogyrus roebucki* (Joshua, 1914), F73607; c–d, *Taeniogyrus tantulus* O’Loughlin sp. nov., paratype F59199: c, dorsal body wall with scattered wheels and subequal hooks; d, ventral body wall with hook ossicles only.

Archedota lapidea O’Loughlin sp. nov.

Figure 1

Material examined. Holotype: Victoria, western Bass Strait, VIMS, NZOI RV *Tangaroa*, cruise 81-T-1, BSS stn 205G, 39°13’36”S, 143°55’36”E, fine sandy shell, 85 m, 23 Nov 1981, NMV F59193 (with microscope slide of ossicles).

Paratype: Western Bass Strait, *Hai Kung*, cruise 81-Hk-1, BSS stn 119G, 39°06’42”S, 143°28’42”E, fine sand with abundant sponges, 92 m, 31 Jan 1981, F59194 (1; with 4 microscope slides).

Description. Up to 17 mm long, 2 mm diameter (paratype); body wall hard, calcareous; anterior dorsal body and tentacles overhang ventral body and tentacles; tentacles withdrawn (both specimens), tentacles digitate, 10, each with predominantly 5 pairs of digits, longest pair distally, shortest pair proximally; calcareous ring with 5 radial 5 interradial plates all fused to form narrow ring; radial plates low, with anterior indentation, rounded posteriorly; interradial plates with concave anterior and posterior

indentations; single dorsal madreporite; 1 polian vesicle, ventral; few ciliated funnels along dorsal alimentary canal/mesentery attachment; 2 unbranched gonad tubules, thick, 1 on each side of dorsal mesentery, joined dorsally at shared gonoduct.

Body wall ossicles plates and wheels, lacking hooks: plates densely massed throughout body wall, thick, closely spinous rim and surface, form irregularly oval with 0–6 lobed projections on rim, single wheel-spoked perforation with complex hub, typically 6 spokes, plates 48–88 μ m wide; wheels sparsely present among plate ossicles, intergrade in form with wheel-spoked plates, some with rounded hexagonal form, 6 spokes, inner margin of rim parallel to outer margin, inner margin with continuous teeth, wheel diameter 48 μ m. Tentacles with rod ossicles, ends bifurcate, curved, swollen centrally, tapering distally, rods lacking side branches or denticulations, rods 56 μ m long.

Colour (preserved). Off-white.

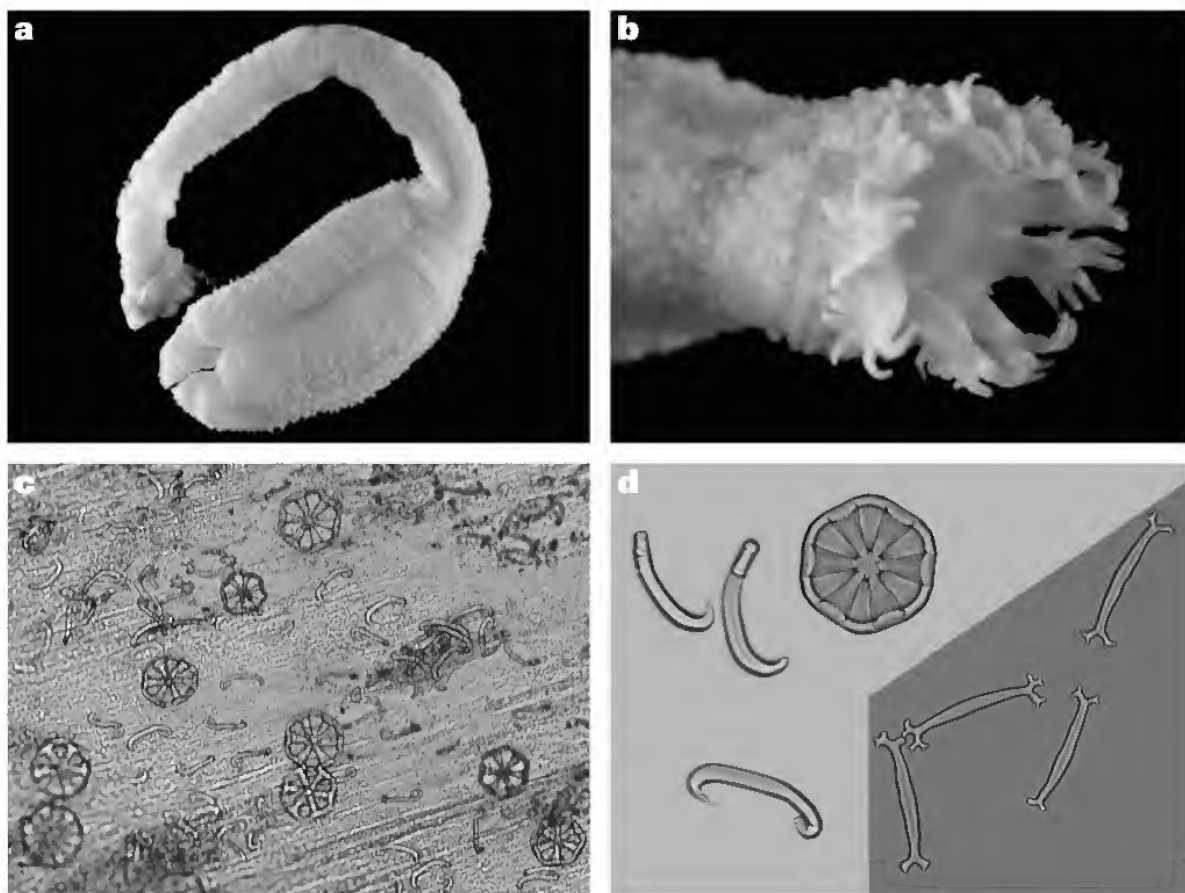


Figure 5. *Taeniogyrus papillis* O'Loughlin sp. nov. a, holotype (preserved) from Beachport, with soft papillate body wall, NMV F59195; b, tentacle crown, with predominantly 5 pairs of digits per tentacle, paratype F59197; c, holotype, section of body wall mount, with scattered subequal wheels and hooks; d, body wall hooks and wheel (left), and tentacle rods (right), all subequal (from types).

Distribution. Western Bass Strait, 39°S 143°E, 92–85 m.

Etymology. From the Latin *lapideus* (of stone), referring to the stone-like ossicles in the body wall (feminine).

Remarks. The body wall ossicle combination of rare chiridotid wheels, irregular spinous plates with single wheel-spoked perforation, and absence of hooks distinguishes *Archedota lapidea* O'Loughlin sp. nov. from all other chiridotid species.

Taeniogyrus Semper, 1868

Figures 2a, 3a,b, 4–7

Diagnosis (as emended by Rowe, 1976). Chiridotid genus with wheels and sigmoid ossicles present, scattered, or in groups or clustered into papillae; wheels with serrations continuous around the inner margin; tentacles 10 or 12.

Species in southern Australia. *Taeniogyrus heterosigmus* Heding, 1931; *T. papillis* O'Loughlin sp. nov.; *T. roebucki*

(Joshua, 1914); *T. tantulus* O'Loughlin sp. nov.

Remarks. An abundance of *T. roebucki* (Joshua) material from southern Australia, including the types, is present in the collections of Museum Victoria and was available for comparative examination. *T. roebucki* differs from the other 3 *Taeniogyrus* species in southern Australia in having only 2 pairs of digits per tentacle. Rowe (1995) reported *T. heterosigmus* Heding as known only from the type locality (Koombana Bay in SW Australia). I have found specimens at Normanville in Gulf St. Vincent in South Australia, in the rock and sediment shallows (NMV F74612 (1), F82706 (4), F82707 (5)), and confirmed their identity with the type (ZMH E.5032). *T. heterosigmus* differs in 3 significant ways from the other 3 species of *Taeniogyrus* in southern Australia: dense round clusters of wheels in the body wall; 2 series of ciliated funnels along the coelomic wall, in the left lateral and right ventral interradii; multiple branching gonad tubules. *T. heterosigmus* is similar to *T. roebucki*: sigmoid hooks significantly larger than wheels; tentacle rods with lateral

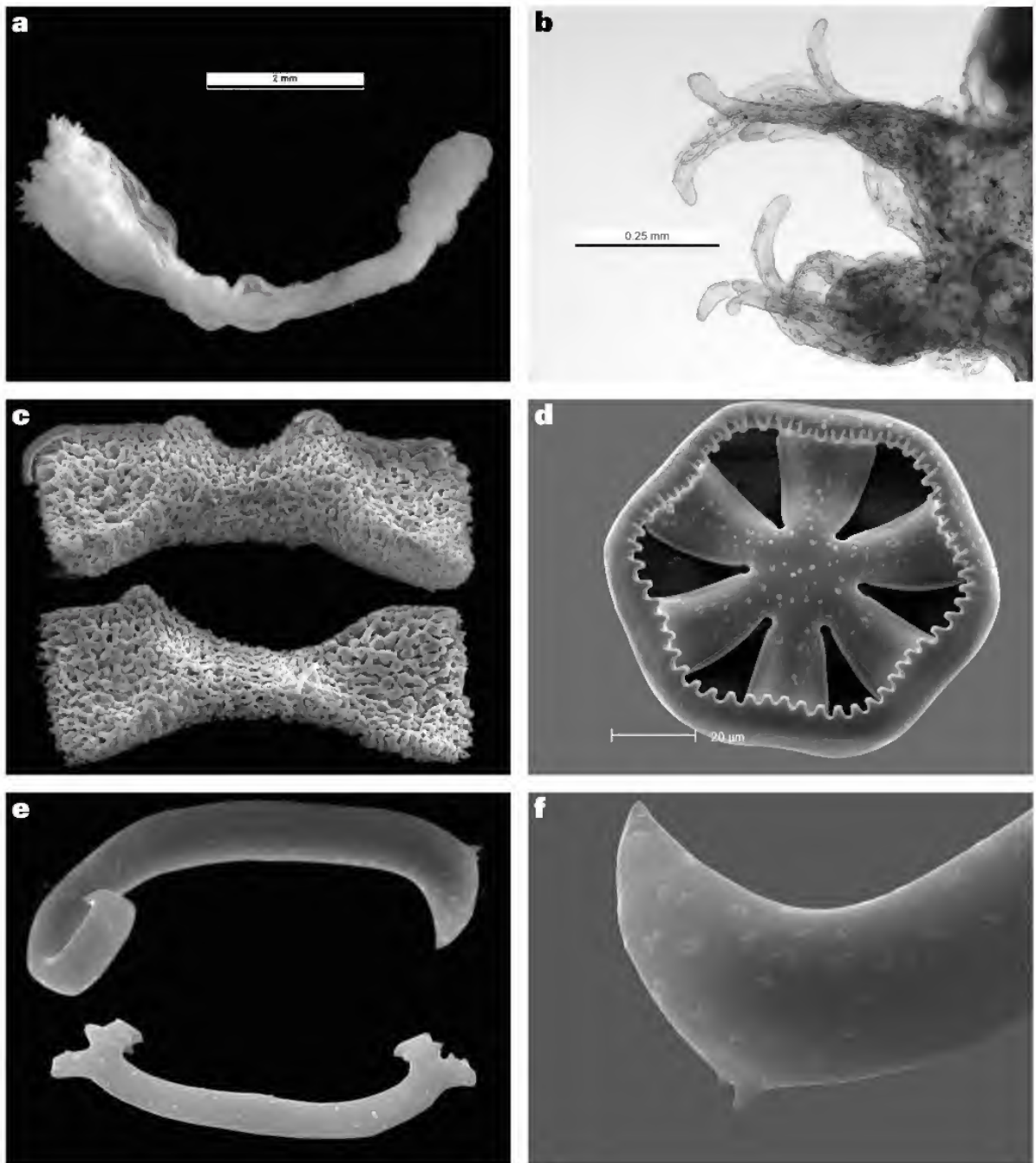


Figure 6. *Taeniogyrus tantulus* O'Loughlin sp. nov. (SEM by Tania Bardsley and Phil Bock). a, holotype (preserved) from East Gippsland, NMV F59198; b, 2 tentacles and digits, with smooth-sided rods, paratype F59199; c, calcareous ring plates from paratype, F59199: radial plate above, interradial plate below; d, wheel from body wall, with continuous series of teeth on inner edge of rim, paratype F59199; e, hook from body wall (above), and rod from tentacle, lacking lateral denticulations (below), paratype F59199; f, end of hook from paratype, with spines on outer curved edge, paratype F59199.

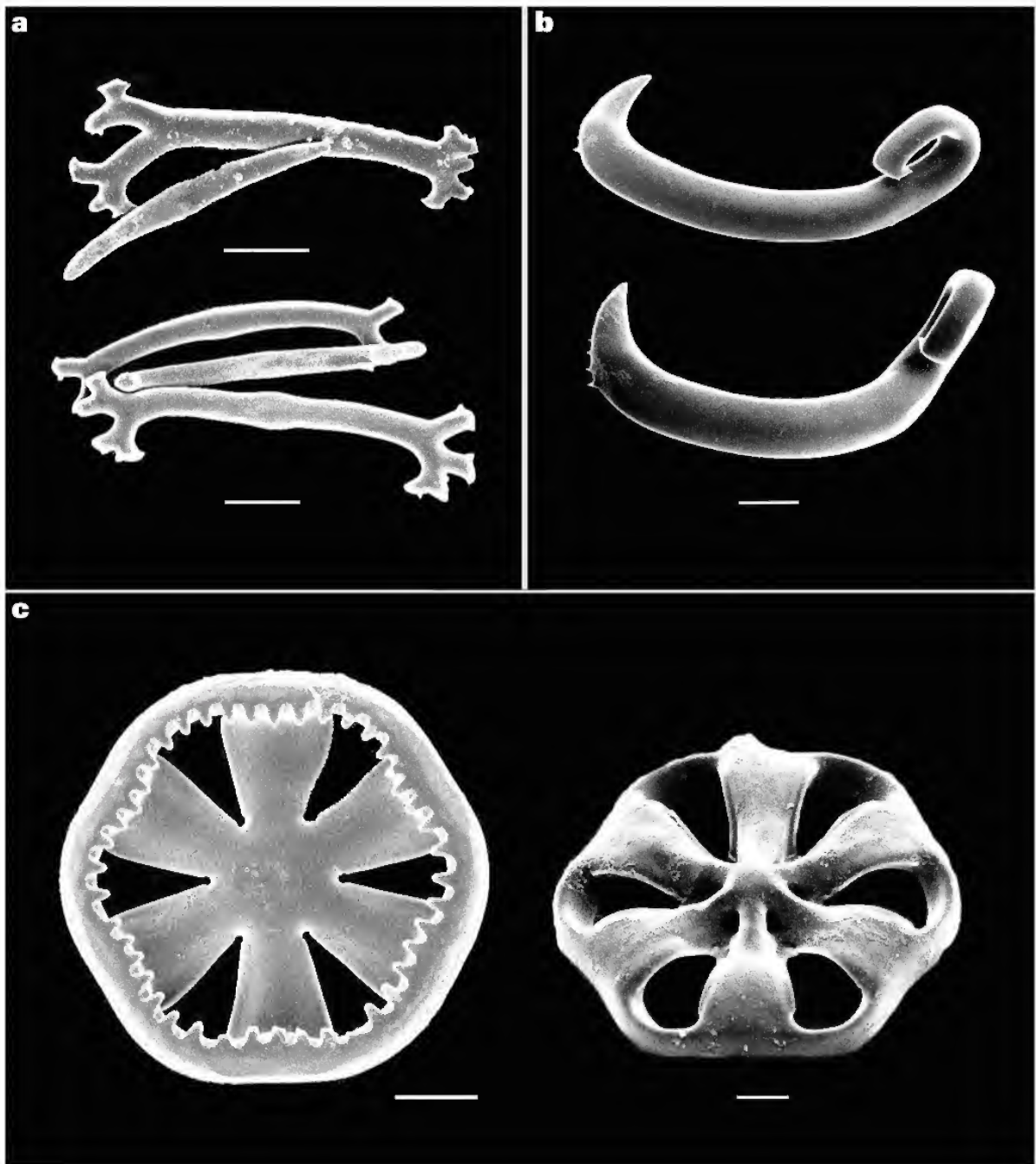


Figure 7. *Taeniogyrus tantulus* O'Loughlin sp. nov. (SEM by Didier VandenSpiegel; paratype NMV F59199; all scale bars 10 μ m). a, tentacle rods, lacking lateral denticulations; b, hooks from body wall, with spines on outer curved edge; c, wheels from body wall, with continuous series of teeth on inner rim, and complex hub.

denticulations that are papillate or sub-columnar, never with additional fine spinelets apically. In *T. heterosigmus* the wheels are in rounded dense clusters; in *T. roebucki* wheels are in close irregular bands adjacent to the longitudinal muscles, and sparse mid-interradially. In *T. heterosigmus* the hooks are scattered in all interradii; in *T. roebucki* hooks are aligned transversely in paired series over the edges of longitudinal muscles.

Key to the southern Australia species of *Taeniogyrus* ♂ *emper*, 1868

1. Body wall with calcareous white spots comprising clustered wheel ossicles; gonad tubules with multiple branching; 2 series of ciliated funnels, not dorsal *T. heterosigmus* Heding
- Body wall lacking white spots of clustered wheel ossicles; gonad tubules not branched; 1 series of ciliated funnels, dorsal 2
2. Tentacles each with 2 pairs of digits; sigmoid hooks significantly larger than wheels; tentacle rods with lateral denticulations *T. roebucki* (Joshua)
- Tentacles each with predominantly 4–5 pairs of digits; sigmoid hooks not significantly larger than wheels; tentacle rods smooth laterally 3
3. Large, up to 60 mm long (preserved); relaxed body wall covered with non-calcareous discrete papillae; papillae dark red; outer curved side of projecting end of hooks smooth; tentacle rods widened mid-rod and tapering distally *T. papillis* O'Loughlin sp. nov.
- Small, up to 11 mm long (preserved); relaxed body wall not covered with discrete papillae; body white; outer curved side of projecting end of hooks minutely spinous; tentacle rods not widened mid-rod *T. tantulus* O'Loughlin sp. nov.

Taeniogyrus papillis O'Loughlin sp. nov.

Figure 5

Material examined. Holotype: SE South Australia, Beachport, "Salmon Hole", shallow sub-littoral, in sand under rock with *Taeniogyrus roebucki*, M. O'Loughlin, 29 Jan 1989, NMV F59195 (1, with 5 microscope slides).

Paratypes: SE South Australia, Cape Northumberland, algal "scrapings", M. Mackenzie, R. McIntosh, M. O'Loughlin, 6 Jan 2001, F94119 (1 in 2 pieces, with 1 microscope slide). Victoria, Marengo (SW of Apollo Bay), M. O'Loughlin, 11 Jan 1980, F59197 (1, with 1 microscope slide); Cape Paterson, rocky shallows, M. O'Loughlin, M. Nyhuis, 29 Jan 1988, F59196 (1, with 2 microscope slides).

Other material. SE South Australia, Cape Banks, W side, off *Caulerpa*, 1 m, CRUST 74, 11 May 1990, F94706 (1, fragment).

Description. Up to 60 mm long, 2 mm diameter (preserved); body wall with close cover of discrete domed projections (papillae) present in extended and contracted specimens; anterior dorsal body and tentacles overhang ventral body and tentacles; tentacles digitate, 10, each with predominantly 5 pairs of digits, longest pair distally, shortest pair proximally; calcareous ring

with 5 radial 5 interradiial plates all fused to form narrow ring; plates low, with concave indentations anteriorly and posteriorly, some plates asymmetrical anteriorly with low blunt anterior projection on one side of indentation; single dorsal madreporite; 1 polian vesicle, ventral; narrow band of ciliated funnels along mid-dorsal interradius, on both sides of mesentery attachment; 2 unbranched gonad tubules, 1 on each side of dorsal mesentery, joined dorsally at shared gonoduct.

Body wall ossicles wheels, sigmoid hooks: wheels scattered in interradii of body wall, sparse ventrally, rounded hexagonal form, 6 spokes, inner margin of rim parallel to outer margin, inner margin with continuous teeth, wheel diameters 64–96 μ m; sigmoid hooks over and adjacent to longitudinal muscles, more numerous and slightly smaller than wheels, outer curved side of hook smooth, hook lengths 64–80 μ m. Papillae lacking concentrations of ossicles. Tentacles with rod ossicles: rods curved, swollen centrally, tapering distally, ends with short lobed to blunt branches, rods lacking side branches or denticulations, rods 56–96 μ m long.

Colour (live). Body translucent with close cover of dark red papillae. Preserved holotype with red flecking on vascular ring, polian vesicles and longitudinal muscles.

Etymology. From the Latin *papilla* (small swelling, bud, nipple), referring to the close cover of small domed protuberances on the body surface.

Distribution. Victoria (Cape Paterson) to SE South Australia (Beachport); rocky shallow sub-littoral, 0–1 m.

Remarks. *Taeniogyrus papillis* sp. nov. is distinguished in the key (above) from the 3 other species of *Taeniogyrus* Semper in southern Australia. The holotype has 3 anterior tubular growth infestations arising near the vascular ring, 2 with short branches distally.

Taeniogyrus tantulus O'Loughlin sp. nov.

Figures 4c,d, 6, 7

Material examined. Holotype: Victoria, East Gippsland, Ninety Mile Beach, off McGaurans Beach, 800 m offshore, 10 m, fine sand, strong currents, LVWSB: SWOP 1, stn 7, Site 2, 31 Dec 1979, data from J. Carey and J. Watson, NMV F59198.

Paratypes: Type locality and date, F59199 (11, with many microscope slides).

Other material. Type locality and date, F82710 (many); stn 6, 31 Oct 1979, F80938 (many).

Description. Up to 11 mm long, 2 mm diameter at oral and anal ends (preserved); preserved form commonly with oral and anal ends swollen, mid-body contracted and narrow, anterior dorsal body and tentacles overhang ventral body and tentacles; tentacles digitate, 10, each with 4–5 pairs of digits, longest pair distally, shortest pair proximally; calcareous ring with 5 radial 5 interradiial plates fused to form narrow ring; radial plates low, with anterior narrow indentation between 2 low rounded projections, shallow concave posterior indentation; interradiial plates with anterior indentation with 1 lateral low rounded projection, shallow concave posterior indentation; single dorsal stone canal, madreporite; 1 polian vesicle, ventral; narrow band

of ciliated funnels along mid-dorsal interradius, on both sides of mesentery attachment; 2 unbranched gonad tubules, 1 on each side of dorsal mesentery, joined dorsally at shared gonoduct.

Body wall ossicles wheels, sigmoid hooks: wheels adjacent to longitudinal muscles in interradii of body wall, sparse in ventral interradii, wheels only ossicles anteriorly, wheels with rounded hexagonal form, 6 spokes, inner margin of rim parallel to outer margin, inner margin with continuous teeth, wheel diameters 40–104 μm ; sigmoid hooks absent anteriorly, scattered throughout interradii in mid-body, more numerous and slightly smaller than wheels, outer curved side of some hooks with spinelets, hook lengths 60–80 μm . Tentacles with rod ossicles: rods not swollen centrally, ends with short lobed branches, rods lacking side branches or denticulations, rods 40–64 μm long.

Colour (preserved). White, translucent.

Distribution. Eastern Victoria, East Gippsland, offshore sediments; 11 m.

Etymology. From the Latin *tantulus* (so small), referring to the very small size of specimens of this species.

Remarks. *T. tantulus* sp. nov. is distinguished in the key (above) from the other species of *Taeniogyrus* Semper in southern Australia. It is a very small holothuroid, extremely abundant in the off-shore sublittoral sediments of east Gippsland. Data from Jan Watson (pers. comm.) gives estimated populations at Stns 6 and 7 of 13,870 per square m. Jan noted (pers. comm.) that nearby sites had only a few individuals. There was no evidence of internal brood-protection or fissiparity in the many individuals examined, but such reproductive strategies could be seasonal. The only material examined here was collected in mid-summer.

***Trochodota* Ludwig, 1891**

Figures 2b, 3c–f, 8, 9

Diagnosis (as emended by Rowe, 1976). Chiridotid genus with wheels and sigmoid ossicles present scattered or in groups, wheels with serrations on the inner margin in well defined groups; tentacles 10.

Species in southern Australia. *Trochodota allani* (Joshua, 1912); *T. epiphyka* O'Loughlin sp. nov.; *T. shepherdii* Rowe, 1976.

Remarks. An abundance of *T. allani* (Joshua) material from southern Australia, including the types, is present in the collections of Museum Victoria and was available for comparative examination. Rowe (1995) reported *T. shepherdii* Rowe as known only from South Australia (the Gulfs and Kangaroo I.). Museum Victoria holds specimens from eastern Victoria (Nooramunga, NMV F82694 (3); Corner Inlet, F82704 (5)) and South Australia (Port Lincoln, 15 m, F82703 (1)). No specimens of *T. shepherdii* have been found on the thoroughly examined coast between Wilsons Promontory (Victoria) and the Gulfs (South Australia). In addition to the form of the wheel ossicles, *T. allani* and *T. shepherdii* are similar in each having: tentacle rods with denticulations on the sides, variable in form from low papillate to columnar to flared or

bifurcate distally, often with a small apical spinelet; 3 series of ciliated funnels, in the dorsal, left lateral and right ventral interradii; spinelets on the outer curved side of hook ossicles, more evident in *T. shepherdii*.

Rowe (1976) emended the diagnosis of *Trochodota* Ludwig, 1891. Subsequently Rowe (1995) discussed in detail the uncertain validity of the generic name *Trochodota*. Smirnov (1997) rejected the emended diagnosis of *Trochodota* by Rowe (1976), without reference to the uncertain validity of *Trochodota* raised by Rowe (1995). Smirnov (1997) reverted to the diagnosis of *Trochodota* by H. L. Clark (1921), while recognizing that "Clark's system itself needs revision". Rowe (pers. comm.) indicates that he disagrees with Smirnov (1997) on the identification of the type species of *Trochodota*, namely *Chirodota studerii* Théel, 1886, sensu Ludwig, 1891 = *Holothuria (Fistularia) purpurea* Lesson, 1830 (not Théel, 1886 = *Taeniogyrus contortus* Ludwig, 1874) (subsequent designation by Rowe, 1995). Resolution of these issues will be undertaken elsewhere, and the emended diagnosis of *Trochodota* by Rowe (1976) is followed here.

Key to the southern Australia species of *Trochodota* Ludwig, 1891

1. Live colour uniform black; wheels grouped in a band along all mid-interradii *Trochodota shepherdii* Rowe
- Live colour never uniform black; wheels scattered, sparse to absent in the 2 ventral interradii 2
2. Smaller, up to 14 mm long (preserved); found predominantly in shallow sublittoral algal growth; live colour white with dark purple to black flecks, consistent; 2 longitudinal series of ciliated funnels (left lateral, right ventral interradii); wheel diameters smaller, 40–160 μm ; sigmoid hooks shorter, 88–136 μm , outer side of curved hooks with paired series of spinelets *Trochodota epiphyka* O'Loughlin sp. nov.
- Larger, up to 80 mm long (live); found predominantly in deep sublittoral sediments; live colour predominantly solid carmine, blood red, variable; 3 longitudinal series of ciliated funnels (dorsal, left lateral, right ventral interradii); wheel diameters larger, 40–184 μm ; sigmoid hooks longer, 136–184 μm , outer side of curved hooks with single series of spinelets *Trochodota allani* (Joshua)

***Trochodota epiphyka* O'Loughlin sp. nov.**

Figure 2b, 8b, e–f, 9

Trochodota allani.—O'Loughlin, 1984: 155.—Rowe, 1995: 268 (part) (non *Trochodota allani* (Joshua, 1912))

Material examined. Holotype: Victoria, Flinders, Mushroom Reef, sieved from *Amphibolus* in rocky shallows, A. Falconer, 20 Apr 2007, NMV F132690 (photo live by Leon Altoff).

Paratypes: (all paratype specimens from algal scrapings in the rocky shallows, collected by M. O'Loughlin). Flinders, West Head, M. Benavides-Serrato, D. Maric, M. O'Loughlin, 27 Jan 2007, F121896 (1); F121897 (1); Flinders, ocean platforms, 13 Apr 1985, F73564 (1); 13 Jul 1990, F73565 (1); 16 Nov 1980, F73566 (3);

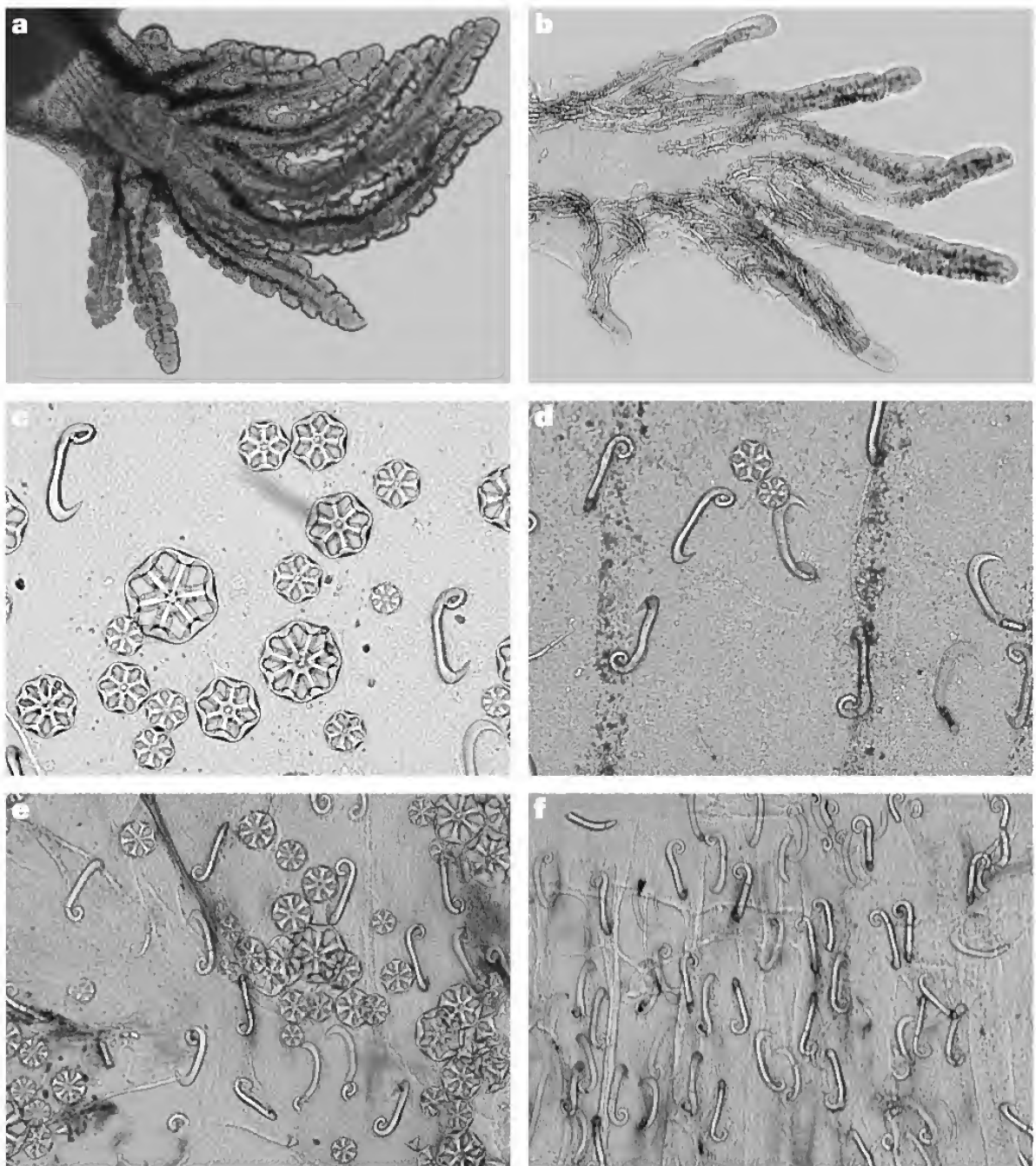


Figure 8. *Trochodota* Ludwig, 1891 species. a, tentacle mount of *Trochodota allani* (Joshua, 1912) with 5 pairs of digits, NMV F45031. b, tentacle mount of *Trochodota epiphyka* O'Loughlin sp. nov. with 3 pairs of digits, and rods with lateral denticulations, paratype F73587. c–f, part body wall mounts at same magnification: c, d: *Trochodota allani*, F82705; c, dorsal body wall with larger wheels and hooks; d, ventral body wall with hooks and rare wheels. e, f, *Trochodota epiphyka*, F73584: e, dorsal body wall with smaller wheels and hooks; f, ventral body wall with hooks, lacking wheels.

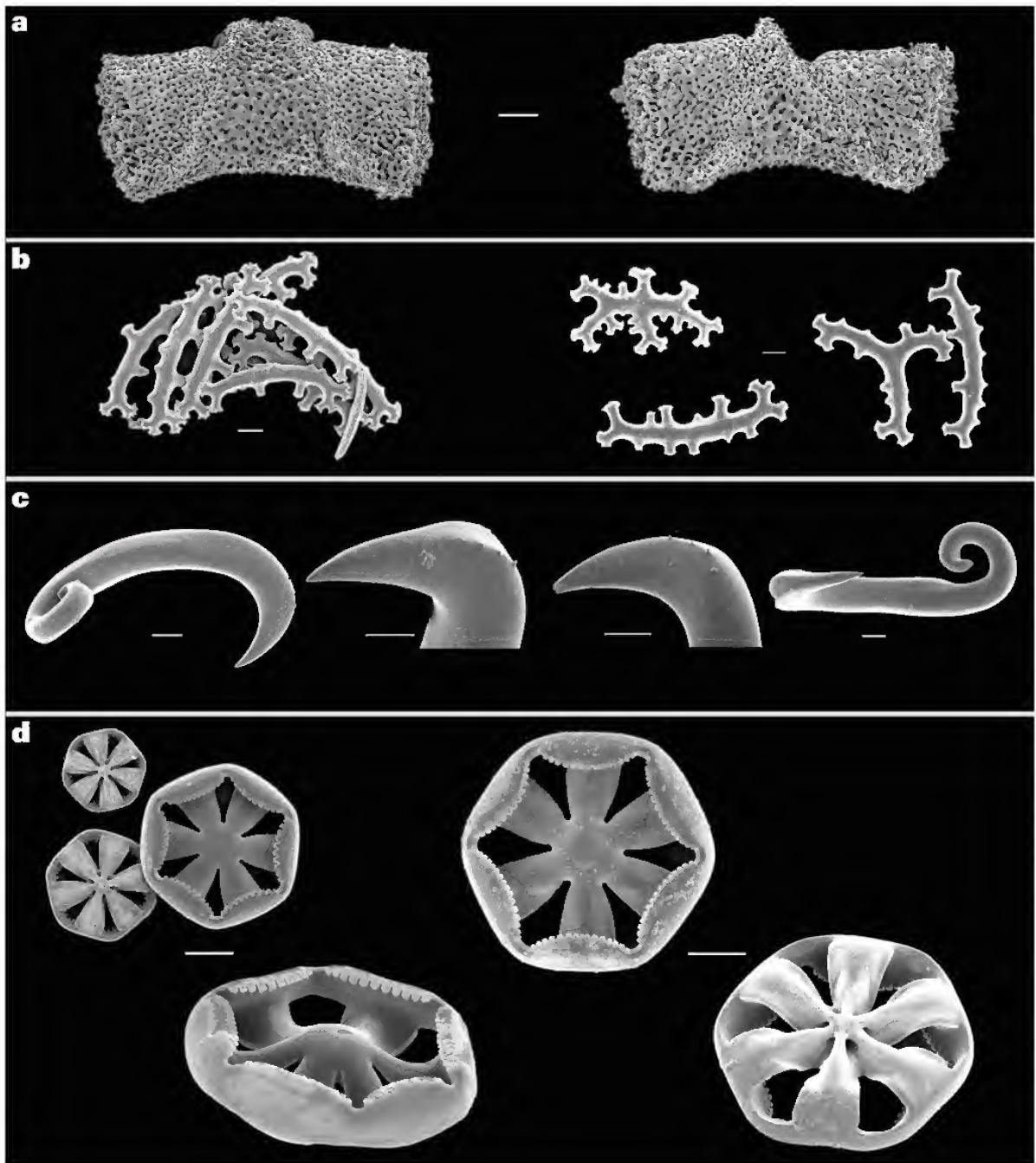


Figure 9. *Trochodota epiphyka* O'Loughlin sp. nov., paratype NMV F73586 (SEM by Didier VandenSpiegel) a, radial and interradial plates of calcareous ring (scale bar 50 μm); b, tentacle rods with lateral denticulations (scale bars 10 μm); c, hooks from body wall, with short paired rows of small spinelets on outer curved edges (scale bars 10 μm); d, wheels from body wall, with discontinuous series of teeth on inner margin of rim, and complex hub (scale bars 20 μm).

Table 1. Wheel ossicle characters for the species of *Prototrochus* Beljaev and Moronov, 1982 from the Tasman Sea: *P. australis* (Beljaev and Mironov, 1981); *P. burni* O'Loughlin sp. nov.; *P. staplesi* O'Loughlin sp. nov.; *P. taniae* O'Loughlin sp. nov. (optical measurements by Mark O'Loughlin)

Species (depth)	Diameter (average)	Spokes (average)	Teeth (average)	Spokes/ teeth ratio	Hub/wheel (diameters)	Rim
<i>P. australis</i> 1500 m	226 μm (155–297) (n = 51)	9 (7–11)	26 (23–30)	34% (25–42)	Not given	Round
<i>P. burni</i> 2900 m	272 μm (240–336) (n = 21)	10 (8–12)	31–35	25–31%	22–25%	Round
<i>P. staplesi</i> 1119 m	136 μm (112–152) (n = 10)	8 (7–9)	18–20	40–50%	14–16%	Scalloped
<i>P. taniae</i> 996 m	232 μm (192–248) (n = 37)	9 (7–10)	24–28	33%	19–20%	Angular

Table 2. Measurements (μm) for 10 “large” wheels of *Prototrochus taniae* O'Loughlin sp. nov. (paratype NMV F59192; SEM measurements by Didier VandenSpiegel; wheel parameters in fig. 10d).

Wheel diameter (averages at bottom)	Hub diameter	Spoke length	Tooth length
179.9	39.5	50.4	20.3
170.8	49.5	49.8	18.0
188.7	45.3	50.0	17.7
184.7	47.6	50.1	20.4
193.8	47.3	57.3	19.9
291.6	54.1	56.0	21.5
212.0	54.3	60.3	23.4
176.6	43.0	48.3	20.5
184.3	42.4	52.8	24.7
191.2	46.9	55.4	23.4
188.4 μm	47.0 μm	53.0 μm	21.0 μm

10 Mar 1980, F73567 (1); 7 Apr 1980, F73568 (3); 6 Mar 1982, F73586 (1, photo by I. Kirwan); 17 Feb 1990, F73587 (5).

Other material (selection). Victoria, Cape Paterson, 25 Jan 1992, F59230 (2); 18 Jan 1980, F73590 (4); Mullet Holes (10 km NE of Apollo Bay), 2 Jan 1988, F73584; Portland, W side of Bridgewater Bay, 25 Feb 2007, F125372 (1, photo live by Leon Altoff). N Tasmania, Lulworth, Black Rock Point, 22 Nov 1982, F82765 (5). South Australia, Robe, 10 Jan 1988, F82766 (3); Victor Harbor, The Bluff, 9 Nov 1988, F82720 (4); Cape Jervis, 10 Nov 1988, F82769 (1); Kangaroo I., Emu Bay, 17 Jan 1990, F82768 (3). Western Australia, Cape Naturaliste, Eagle Bay, 25 Feb 1975, WAM Z464–76 (1).

Description. Up to 14 mm long, 2 mm diameter (preserved); anterior dorsal body and tentacles overhang ventral body and tentacles; tentacles digitate, 10, each with predominantly 3 pairs of digits, longest pair distally, shortest pair proximally; calcareous ring with 5 radial 5 interradiial plates all fused to form narrow ring; radial plate subrectangular with narrow

short truncate anterior projection, shallow concave posterior indentation; interradiial plate asymmetrical with mid-anterior small notch and short projection, concave indentation posteriorly; single dorsal stone canal, hook-shaped madreporite; 1 polian vesicle, ventral; 2 narrow bands of ciliated funnels along left lateral interradius adjacent to left ventrolateral muscle, and along right ventral interradius adjacent to midventral muscle; 2 unbranched gonad tubules, 1 on each side of dorsal mesentery, joined dorsally at shared gonoduct.

Body wall ossicles wheels, sigmoid hooks: wheels in dorsal and lateral interradii, no wheels in 2 ventral interradii, not grouped into papillae, wheels with 6 spokes, rarely more, outer rim of wheels with rounded hexagonal form, inner rim not parallel to outer rim, undulating, wide across spokes with continuous teeth, narrow between spokes and lacking teeth at narrowest part, wheel diameters 40–160 μm ; sigmoid hooks evenly distributed around body, outer side of curved hooks with short parallel series of

minute spinelets, hook lengths 88–136 μm . Tentacles with rod ossicles: rods curved, slightly tapering distally, ends with short lobed branches, rods with irregular side denticulations, papillate to short columnar to bifurcate, some flared distally, often with small spinelet apically, rod lengths 64–80 μm .

Colour (live). Body white, cream or grey, with dark flecks or broken bands of purple, brown or black; tentacles white.

Distribution. From Cape Paterson (eastern Victoria) to Cape Naturaliste (south-western Australia), northern Tasmania; shallow sub-littoral on algae.

Etymology. From the Greek *epi* (upon) and *phykos* (seaweed, alga), referring to the microhabitat of the species (feminine).

Remarks. In contrast with the small size and broken colours of *Trochodota epiphyka* O'Loughlin sp. nov., Joshua (1912) reported *T. allani* to be 80 mm long and 6 mm wide, and described the live colour as carmine and blood red (Joshua, 1914). *T. epiphyka* is distinguished in the key above from the other two species of *Trochodota* in southern Australia.

Suborder **Myriotrochina** Smirnov, 1998

Diagnosis (Smirnov, 1998). Ten or 12 digitate or peltato-digitate tentacles. Plates of calcareous ring with large anterior projections; excavations for tentacular ampullae are on anterior side of calcareous ring. Madreporite placed close to water ring. No ciliated funnels. One polian vesicle. Body wall ossicles represented by wheels with large numbers of spokes (8–25) and without a complex hub (only Family Myriotrochidae).

Myriotrochidae Théel, 1877

Diagnosis. As for suborder.

Prototrochus Beljaev and Mironov, 1982

Figures 10, 11; Tables 1, 2

Diagnosis (after Gage and Billett, 1986). Myriotrochid with 10 tentacles; calcareous ring symmetrical, with dorsal and ventral plates subequal in size; dorsolateral radial plates with single anterior projection; wheels with teeth distributed regularly, pointing towards centre of hub; rods absent from body wall, sometime occurring in and around tentacles.

Remarks. Beljaev and Mironov (1982) referred 12 species to their new genus *Prototrochus*. Only *Prototrochus australis* (Beljaev and Mironov, 1981) occurs near eastern Australia, the holotype coming from south of Lord Howe I. in the northern Tasman Sea at 1500 m. Beljaev and Mironov (1981) noted that their new species *Myriotrochus australis* was the smallest known myriotrochid. The 7 specimens comprise 2 complete and 5 incomplete specimens, none longer than 2.8 mm. The holotype (Stn 1244; oral end part specimen; less than 2 mm long) diagnostic characters of the “larger wheels” given by Beljaev and Mironov (1981) are summarized in Table 1. These characters vary greatly across the specimens of *Prototrochus australis* analysed by Beljaev and Mironov (1981), as do the distribution (5 locations from east of New Zealand to northern

Tasman Sea) and depth range (570–3013 m), suggesting to me the probability of more than 1 species. Beljaev and Mironov (1981) acknowledged that their new species might well comprise “two or more species or subspecies”. The 3 new species from eastern Australia described below are diagnosed against the “larger wheels” data and illustrations given for the holotype of *P. australis* (Stn 1244). The 3 new species described below are the first myriotrochid records for Australian continental waters.

Prototrochus burni O'Loughlin sp. nov.

Figure 10e; Table 1

Material. Holotype: Eastern Australia, E Victoria, 96 km S of Point Hicks, 38°40'S, 149°17'E, 2900 m, lower continental slope, compacted clay, stn SLOPE 66, RV *Franklin*, G.C.B. Poore et al., 25 Oct 1988, NMV F94697 (with 2 microscope slides of wheel ossicles).

Description. Anterior body part; length 2.0 mm; calcareous ring diameter 1.0 mm; 10 peltato-digitate tentacles; calcareous ring symmetrical, 10 plates, dorsal and ventral plates subequal, radial and interrational plates with single long anterior spire, radially digitiform and distally narrowly rounded, interrational narrower and distally pointed, all plates with posterior indentations, lacking posterior projections.

Body wall ossicles massed wheels only: average (21) wheel diameter 272 μm (range 240–336 μm); spokes thick, average 10 per wheel (range 8–12); wheel rim slightly undulating, not angular rounded, not scalloped or straight across each tooth; wheel hubs simple, not perforated; hub diameter 56 μm for wheel diameter 256 μm (22%), hub diameter 80 μm for wheel diameter 320 μm (25%); wheel teeth subequal in size, distributed regularly around inner rim, not aligned with spokes, bluntly rounded, all pointing towards hub; small 8 spoke wheel with 32 teeth (25%), large 11 spoke wheel with 35 teeth (31%); tooth length 3 μm for wheel diameter 30 μm (10%), tooth length 6 μm for wheel diameter 42 μm (14%). Tentacles lack ossicles.

Colour. Off-white, translucent; tentacles with large brown spot distally, small pair proximally.

Distribution. Eastern Australia, E Victoria, S of Point Hicks, lower continental slope; 2900 m.

Etymology. Named for Robert Burn (Marine Research Group of Victoria; Honorary Associate of Museum Victoria), in appreciation of his decades of generous and dedicated contribution to marine research and Museum Victoria, and his invaluable service to the Marine Research Group.

Remarks. *Prototrochus burni* O'Loughlin sp. nov. is based on a single small part-specimen. Tentacles, calcareous ring, and wheel ossicles are all present, and adequate for a specific diagnosis. The symmetrical calcareous ring, with single long anterior projection on each plate and 10 tentacles, wheels with evenly distributed teeth pointing towards the hub, and absence of rod ossicles, identify the new species as a *Prototrochus* Beljaev and Mironov, 1982. The large diameter of the wheels and high number of teeth per wheel distinguish *P. burni* sp.

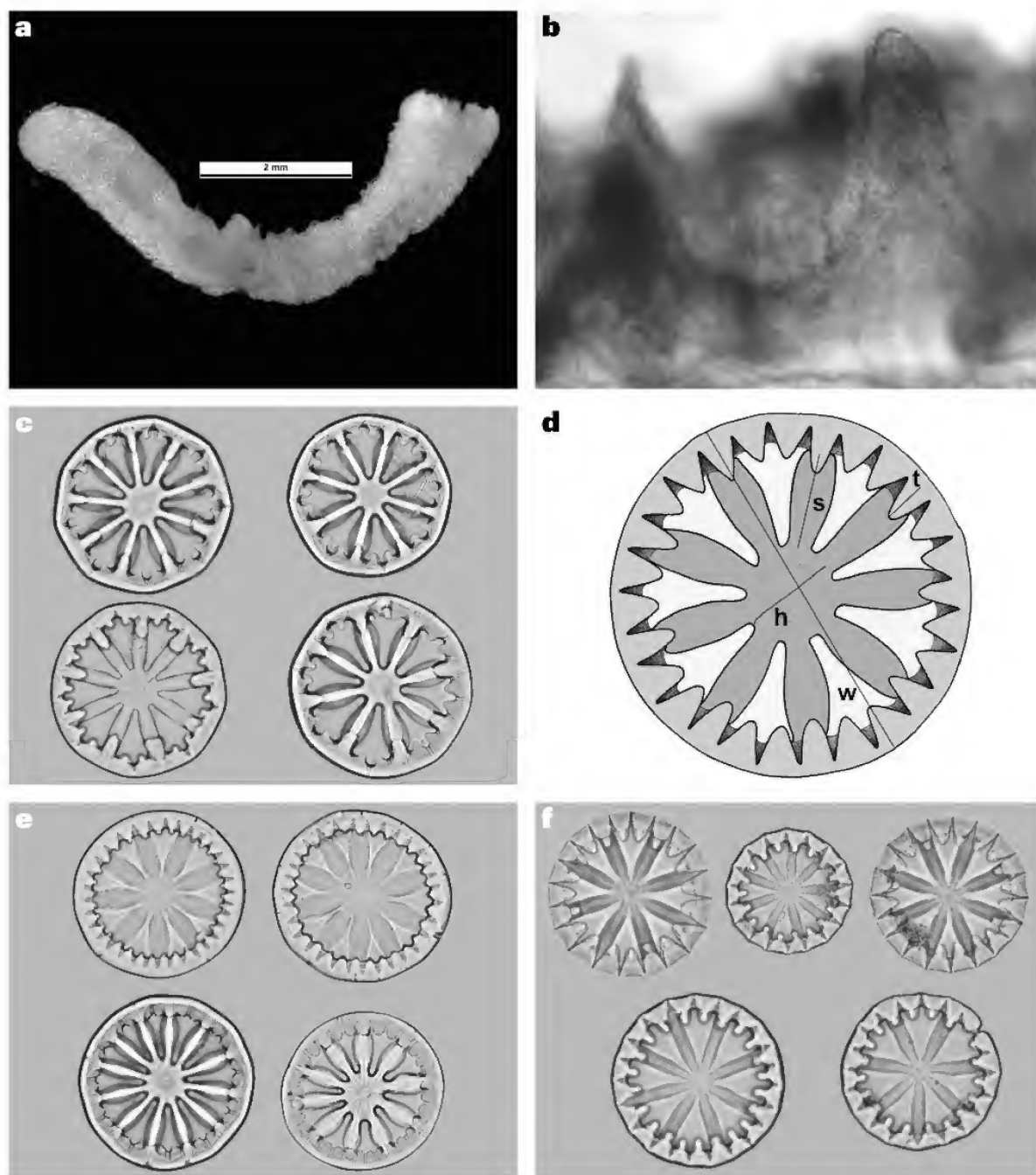


Figure 10. Species of *Prototrochus* Beljaev and Mironov, 1981. a–d, *Prototrochus taniae* O’Loughlin sp. nov.: a, holotype (preserved), NMV F59191; b, anterior projections of interradial and radial plates of calcareous ring, paratype F59192; c, wheels from body wall, with longer teeth over spokes, and angular margin almost flat over spokes, holotype F59191; d, wheel parameters measured by Didier VandenSpiegel for data in Table 2. e, *Prototrochus burni* O’Loughlin sp. nov., wheels from body wall with rounded rim, subequal teeth and more than 8 spokes, holotype F94697. f, *Prototrochus staplesi* O’Loughlin sp. nov., wheels from body wall with flat or shallow concave outer rim over each tooth, subequal teeth, holotype F94698.

nov. from *P. australis* (Beljaev and Mironov), *P. staplesi* sp. nov. (below) and *P. taniae* sp. nov. (below). In the data given by Beljaev and Mironov (1981) the "bigger" wheel diameters of the holotype of *P. australis* are significantly larger than for any of their other *P. australis* specimens. All are significantly smaller than the *P. burni* wheels. *P. burni* occurs at a significantly greater depth (2900 m) than the holotype of *P. australis* and the other new species (below) (Table 1).

***Prototrochus staplesi* O'Loughlin sp. nov.**

Figure 10f; Table 1

Material. Holotype. Eastern Australia, Victoria, 67 km S of Point Hicks, 38°24'S, 149°16'E, 1119 m, upper continental slope, fine mud, stn SLOPE 67, RV *Franklin*, G.C.B. Poore et al., 25 Oct 1988, NMV F94698 (microscope slide of wheel ossicles).

Description. Anterior body part; length 1.2 mm; calcareous ring diameter 1.0 mm; 10 peltato-digitate tentacles; calcareous ring symmetrical, 10 plates, dorsal and ventral plates subequal, radial and interradial plates with single long anterior spine, radially digitiform and distally narrowly rounded, interradially narrower and distally pointed, all plates with posterior indentations, lacking posterior projections.

Body wall ossicles massed wheels only; average (10) wheel diameter 136 μ m (range 112–152 μ m); spokes thin, average 8 per wheel (range 7–9); wheel rim slightly scalloped to straight across each tooth; wheel hubs simple, not perforated; hub diameter 24 μ m for wheel diameter 152 μ m (16%), hub diameter 16 μ m for wheel diameter 112 μ m (14%); wheel teeth subequal in size, distributed regularly around inner rim, not aligned with spokes, bluntly rounded, all pointing towards hub; teeth large, small 9 spoke wheel with 18 teeth (50%), large 8 spoke wheel with 20 teeth (40%); tooth length 16 μ m for wheel diameter 112 μ m (14%), tooth length 24 μ m for wheel diameter 152 μ m (16%). Tentacles lack ossicles.

Colour. Off-white, translucent; tentacles lacking brown spots.

Distribution. Eastern Australia, off eastern Victoria, upper continental slope; 1119 m.

Etymology. Named for David Staples (Marine Research Group of Victoria; Honorary Associate of Museum Victoria), in appreciation of his decades of generous and dedicated contribution to marine research and Museum Victoria, and his invaluable service to the Marine Research Group.

Remarks. *Prototrochus staplesi* O'Loughlin sp. nov. is based on a single small part-specimen. Tentacles, calcareous ring, and wheel ossicles are all present, and adequate for a specific diagnosis. The symmetrical calcareous ring, with single long anterior projection on each plate and 10 tentacles, wheels with evenly distributed teeth pointing towards the hub, and absence of rod ossicles, identify the new species as a *Prototrochus* Beljaev and Mironov, 1982. The small diameter of the wheels, wheel rims slightly scalloped or straight across each tooth, small wheel hubs, and large teeth distinguish *P. staplesi* sp. nov. from *P. australis* (Beljaev and Mironov), *P. burni* sp. nov. and *P. taniae* sp. nov. (below) (Table 1).

***Prototrochus taniae* O'Loughlin sp. nov.**

Figures 10a–d, 11; Tables 1, 2

Material. Holotype: Eastern Australia, New South Wales, 54 km ESE of Nowra, 34°53'S, 151°17'E, 996–990 m, upper continental slope, mud, fine sand, fine shell, stn SLOPE 53, RV *Franklin*, G.C.B. Poore et al., 22 Oct 1988, NMV F59191 (with microscope slide of ossicles).

Paratypes: Type locality and date, F59192 (4, with 2 microscope slides of ossicles and 1 anterior body mount).

Description. Up to 7 mm long; calcareous ring and body diameter 1.0 mm; 10 peltato-digitate tentacles, each with 3 pairs of digits; calcareous ring symmetrical, dorsal and ventral plates subequal, 10 plates, radial and interradial plates with single long anterior spine, radially digitiform and distally rounded, interradially narrower and distally pointed, all plates with posterior indentations, lacking posterior projections; single dorsal madreporite; single ventral polian vesicle; branched gonad tubules.

Body wall ossicles massed wheels only, present dorsally and laterally, absent ventrally: average (37) wheel diameter 232 μ m (range 192–248 μ m); spokes thin, average 9 per wheel (7–10); wheel rim slightly angular rounded, not scalloped, rounded angles between spokes, flat across spokes; wheel hubs simple, lacking perforations, hub diameter 48 μ m for wheel diameter 248 μ m (20%), hub diameter 40 μ m for wheel diameter 208 μ m (19%); teeth distributed regularly around inner rim, all pointing towards hub, bluntly rounded, 2 sizes, longer teeth aligned with spokes, shorter teeth between spokes; for wheel diameter 240 μ m longer teeth 40 μ m, shorter teeth 32 μ m; when 9 spokes 27 teeth (33%), when 8 spokes 24 teeth (33%). Tentacles lacking ossicles.

Colour. Off-white, translucent; tentacles each with brown lateral bands.

Distribution. Eastern Australia, off southern NSW, upper continental slope; 996 m.

Etymology. Named for Tania Bardsley (formerly of the Marine Science Section of Museum Victoria), in appreciation of her personal collaboration in my holothuroid research, and her significant contribution to marine science systematics.

Remarks. *Prototrochus taniae* O'Loughlin sp. nov. is based on 1 complete and 5 small part-specimens. The symmetrical calcareous ring, with single long anterior projection on each plate, and 10 tentacles, wheels with evenly distributed teeth pointing towards the hub, and absence of rod ossicles, identify the new species as a *Prototrochus* Beljaev and Mironov, 1982. The angular rounded wheel rims, and 2 sizes of teeth, the longer teeth aligned with spokes, distinguish *P. taniae* sp. nov. from *P. australis* (Beljaev and Mironov), *P. burni* sp. nov. and *P. staplesi* sp. nov. (Table 1). In the SEM images of the larger wheels in *P. taniae* Didier observed rare ones with rounded rims and subequal teeth, but the wheels were predominantly as described and illustrated with longer teeth over the spokes. Beljaev and Mironov (1981) reported no such character. Rare small wheels were observed in the SEM images of the paratype of *P. taniae*, some with a rim like *P. staplesi* sp. nov. and with more numerous spokes. The

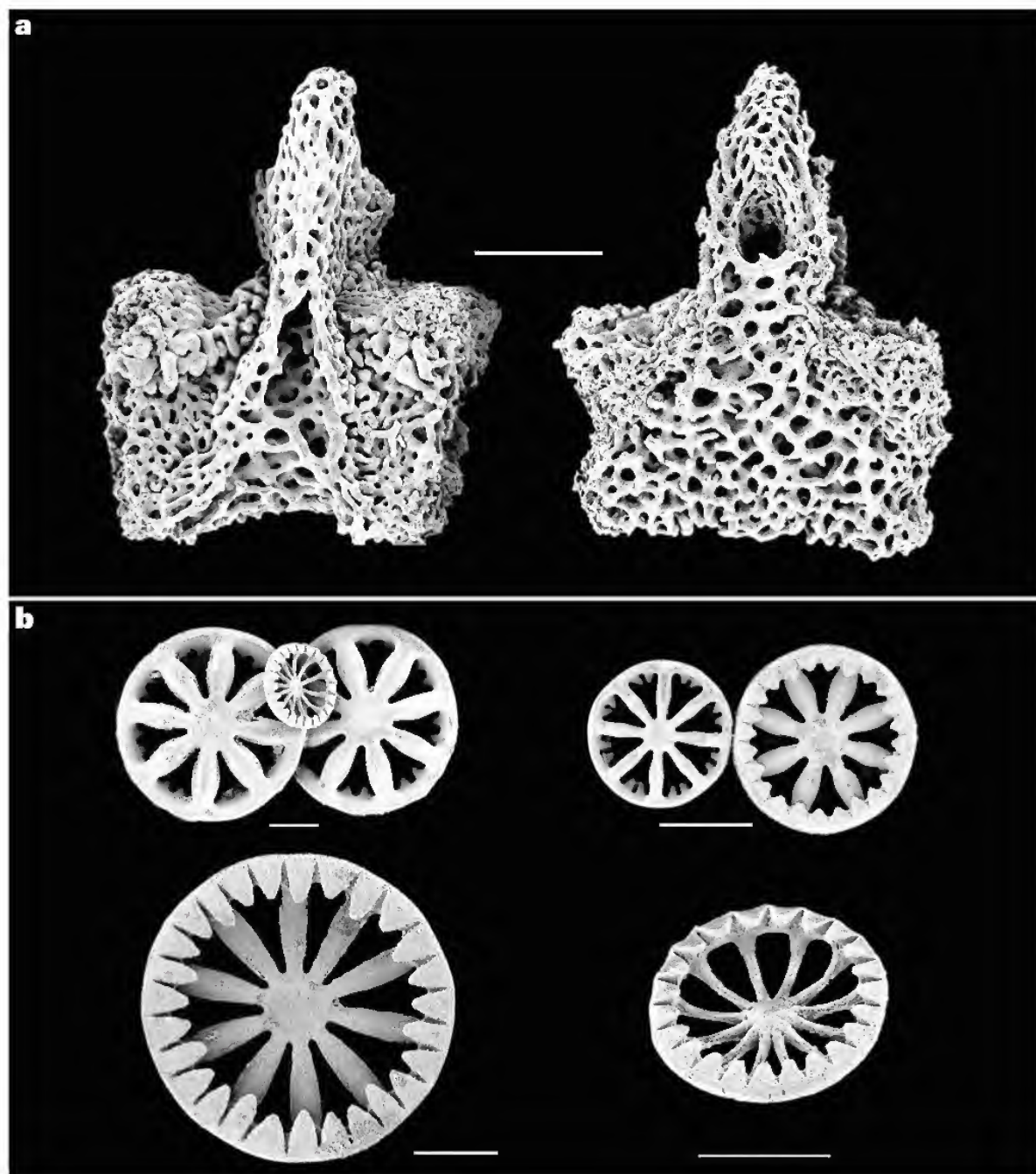


Figure 11. *Prototrochus taniae* O'Loughlin sp. nov., paratype NMV F59192 (SEM by Didier VandenSpiegel). a, radial plates of calcareous ring with canal (outer view left, inner view right; scale bar 100 μm); b, wheels from body wall (scale bars 50 μm except bottom right bar 20 μm).

diagnosis here is based on large wheel comparisons. The lengths of the wheel teeth in the description above were measured to the edge of the rim (for wheel diameter 240 μm longer teeth 40 μm , shorter teeth 32 μm). The SEM measurements (average 21.0 μm) were measured to the inner rim (see fig. 10d).

Acknowledgments

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A new fissiparous micro-asteriid from southern Australia (Echinodermata: Asteroidea: Asteriidae)

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Abstract

Benavides-Serrato, M., O'Loughlin, P. M., and Rowley, C. 2007. A new fissiparous micro-asteriid from southern Australia (Echinodermata: Asteroidea: Asteriidae). *Memoirs of Museum Victoria* 64: 71–78

The fissiparous micro-asteriid *Allostichaster palmula* Benavides-Serrato and O'Loughlin sp. nov. from south-eastern Australia is described. The diagnostic characters of juveniles of the four other shallow asteriid genera and species from south-eastern Australia are discussed: *Allostichaster polyplax* (Müller and Troschel); *Coscinasterias muricata* Verrill; *Smilasterias multipara* O'Loughlin and O'Hara; *Uniophora granifera* (Lamarck). Diagnostic characters are tabulated. Photos are provided. Fissiparity in these asteriids is noted. The R/r ratio is discussed.

Keywords

Echinodermata, Asteroidea, Asteriidae, *Allostichaster*, new species, fissiparity, taxonomy

Introduction

The rocky littoral and shallow sublittoral coast of south-eastern Australia has been surveyed thoroughly for marine invertebrates. As a result, Museum Victoria houses many small juvenile asteroid specimens. In this study the juveniles of the family Asteriidae were isolated and determined. Four asteriid species occur abundantly on this coast, and are represented in the museum collections by many juveniles: *Allostichaster polyplax* (Müller and Troschel, 1844); *Coscinasterias muricata* Verrill, 1867; *Smilasterias multipara* O'Loughlin and O'Hara, 1990; *Uniophora granifera* (Lamarck, 1816). During this study small specimens of a fifth asteriid fissiparous species were found. This species is new to science, and is represented by seven very small specimens. Recently a live specimen was found in Port Phillip Bay, and photographed.

For comparative diagnoses, small juveniles of all five asteriid species were compared, and photographed by Chris Rowley using a Leica MZ16 stereomicroscope, Leica DC500 digital camera, and “Auto-Montage” software for composition of images. Museum Victoria (NMV) registration number prefix is F.

Forcipulatida Perrier, 1844

Remarks. In diagnosing the Forcipulatae, Perrier (1844) referred to the 2-valved pincer-like pedicellariae, frequent 4 rows of tube feet, normally reticulate skeleton, and at least part cover of spines that are rarely granular. Subsequently Fisher (1928) noted for the order Forcipulata: stellate form with

5 or more arms, frequently long and slender; crossed and/or straight pedicellariae; reticulate skeletal plates in definite longiseries with marginal and carinal series usually regular; ambulacral and adambulacral plates equal in number, short and crowded, compressing the double series of tube-feet into 2 zigzag, 4 or even 6 longiseries; mouth plates frequently inconspicuous, sunken in actinostome. Recently Liao and Clark (1995) followed Blake (1987), and diagnosed the order Forcipulatida as having “disc relatively small, often well-defined, and arms almost cylindrical, marginals not conspicuous, inferomarginals aligned ventrolaterally; abactinal skeleton usually reticulate but sometimes compact, at least a carinal longitudinal series more or less evident; ambulacral plates numerous, very short, often staggered, at least proximally, to bring the suckered tube feet into four longitudinal series; oral plates narrow; papulae also present on lower side; pedicellariae consisting of a basal piece and two valves, either straight or crossed, or both”. Our observations in this study found conspicuous marginal plates on some species, and did not always find papulae on the lower side. We question these recent diagnostic characters of the Forcipulatida.

Asteriidae Gray, 1840

Remarks. Gray (1840) diagnosed his family Asteriidae as “skeleton netted with a single mobile spine at each anastomosis of the ossicula; body covered with more or less prominent elongate mobile spines”. Fisher (1928) considered the Asteriidae to be a “polyphyletic aggregation of genera placed for

Table 1. Diagnostic distinctions between *Allostichaster palmula* Benavides-Serrato and O'Loughlin sp. nov., *Coscinasterias muricata* Verrill, *Smilasterias multipara* O'Loughlin and O'Hara and *Uniophora granifera* (Lamarck) for specimens with R up to 6 mm.

Diagnostic character	<i>Allostichaster palmula</i>	<i>Coscinasterias muricata</i>	<i>Smilasterias multipara</i>	<i>Uniophora granifera</i>
Number of arms	predominantly 6	predominantly 10	5	5
Fissiparity	fissiparous	fissiparous	non-fissiparous	non-fissiparous
Abactinal plates	closely imbricate	openly reticulate	openly reticulate	closely imbricate
Dorsolateral plates	none	link carinal and superomarginal plates	link carinal and superomarginal plates	none
Carinal series	regular	regular	regular	irregular
Carinal plates	quadrilobed form	oblong-elliptical form	quadrilobed form	trilobed form
Abactinal spinelets	distally widened or columnar; coarsely spinous	styliform; acicular spiniform	sub-capitate to slightly tapered deeply serrate	globose and subcolumnar form; finely spinous
Pedicellariae	crossed abactinally, straight in furrow	crossed around spines only	crossed only, not in furrow	crossed only, not in furrow
Superomarginal plates	lobed on proximal edge	cruciform	cruciform	diamond shape
Superomarginal spinelets	up to 3 per plate	one per plate	two per plate	one per plate
Inferomarginal spines	single, broad blade distally	two styliform	one truncate, not flared	two globose
Actinal plates	none	long series	none	proximal to disc only

Table 2. Diagnostic distinctions between *Allostichaster palmula* Benavides-Serrato and O'Loughlin sp. nov. and *Allostichaster polyplax* (Müller and Troschel) for specimens with R up to 6 mm.

Diagnostic character	<i>Allostichaster palmula</i>	<i>Allostichaster polyplax</i>
Form of arms	broad, not tapering, blunt	narrow, tapering, pointed
Abactinal spinelets	distally widened or columnar, coarsely spinous	mostly globose, few columnar, finely spinous distally
Form of carinal plates	quadrilobed	triangular
Superomarginal plates	proximal lobe prominent	lacking prominent proximal lobe
Inferomarginal plates	predominantly monacanthid	predominantly diplacanthid
Inferomarginal spines	narrow basally, short broad blade distally	elongate club-shaped
Adambulacral spines	pairs per plate digitiform, subequal	subambulacral spine broader than furrow spine

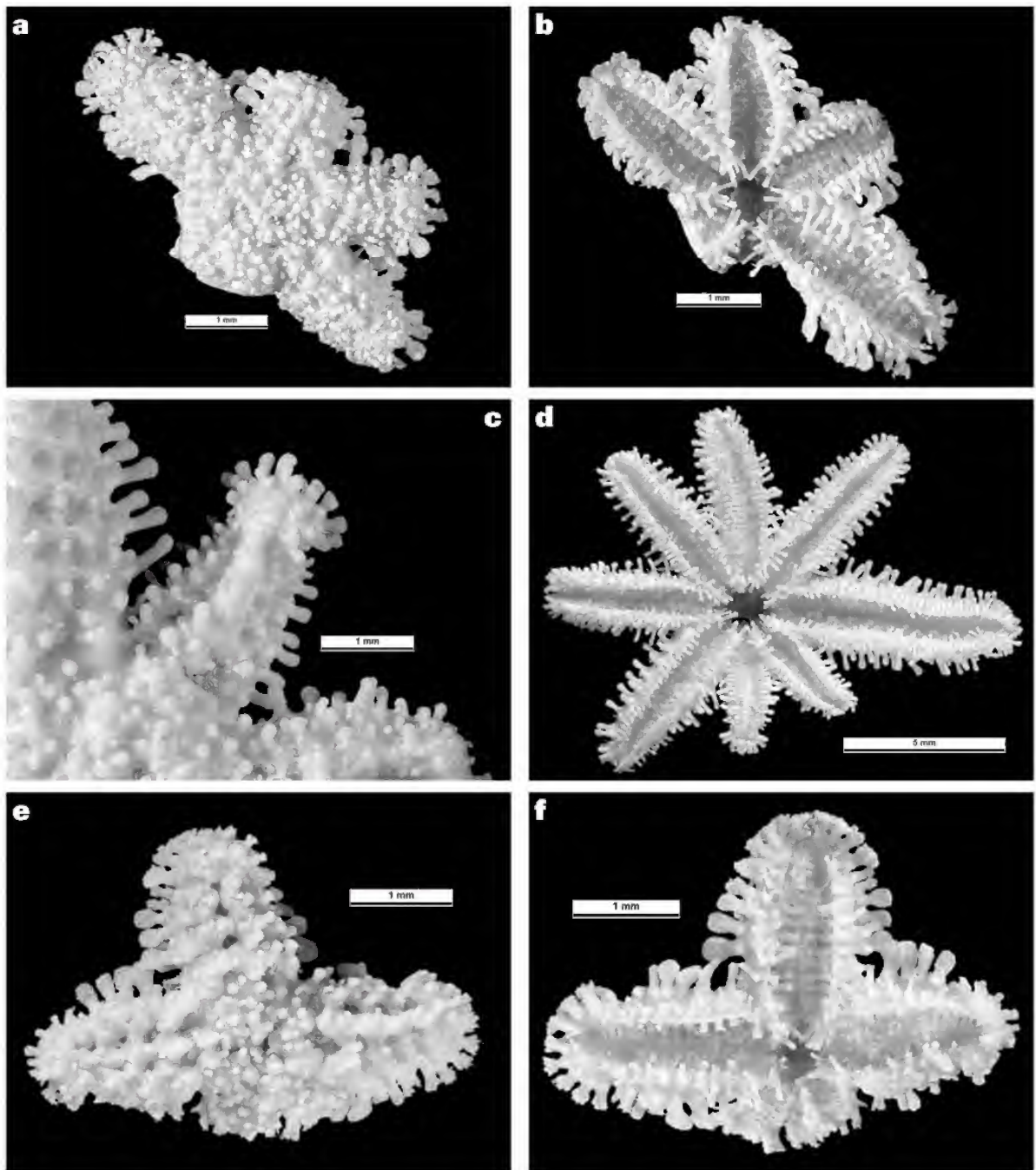


Figure 1. a, b. *Allostichaster palmula* Benavides-Serrato and O'Loughlin sp. nov. (NMV F113585, holotype): a, abactinal view showing blunt arms, post-fissiparous form, paddle-like inferomarginal spines; b, actinal view showing evidence of 6 arms (2 large, 2 small, 2 detached not shown). c, d. *Allostichaster polyplax* (Müller and Troschel) (F73988): c, abactinal view of regenerating arm showing clavate marginal spines; d, actinal view showing post-fissiparity form and typical 8 arms. e, f. *Allostichaster palmula* (NMV F113566, paratype): e abactinal view showing post-fissiparous form, carinal series, papular spaces, and paddle-like inferomarginal spines; f, actinal view showing 3 normal blunt arms and 2 detached not present.

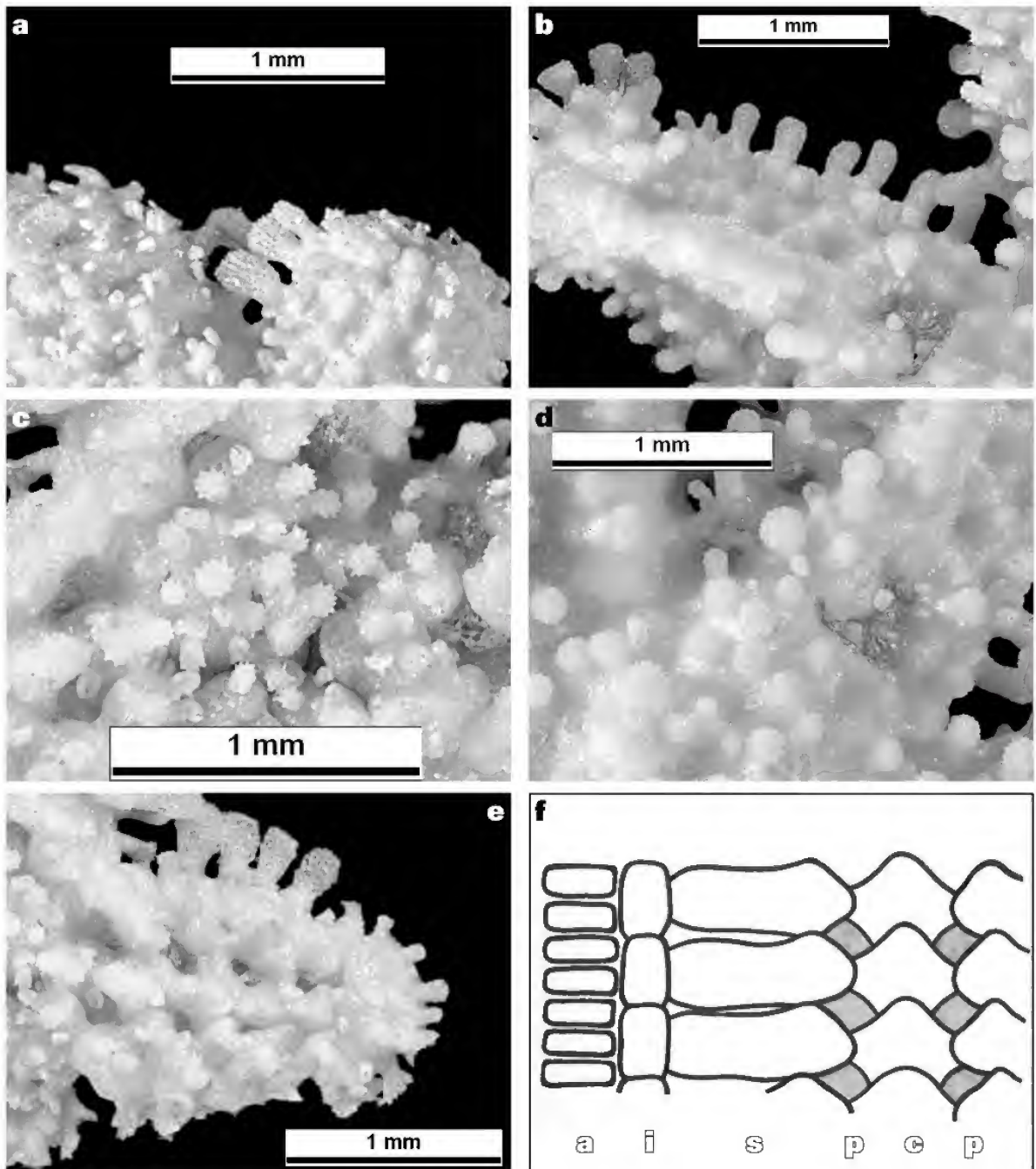


Figure 2. a. *Allostichaster palmula* sp. nov. (NMV F113585): abactinal view showing 2 typical inferomarginal spines (centre) with distinct stem, broad flat blade with vertical and radiating ribs, and coarsely serrate distal edge. b. *Allostichaster polyplax* (F73988): abactinal view showing clavate inferomarginal spines. c. *Allostichaster palmula* (NMV F113566): abactinal view of disc showing distally widened, coarsely spinous, spinelets, and small crossed pedicellaria (top). d. *Allostichaster polyplax* (F73988): abactinal view of proximal arm showing finely spinous globose and subcolumnar spinelets, and small crossed pedicellaria (top). e. *Allostichaster palmula* (NMV F113566): abactinal view of arm showing carinal series, papular spaces, and typical paddle-shaped inferomarginal spines (top). f. diagram showing typical skeletal plates of an arm of *Allostichaster palmula*: a, adambulacral; i, inferomarginal; s, superomarginal; p, papular space (shaded); c, carinal (proximal ray at top).

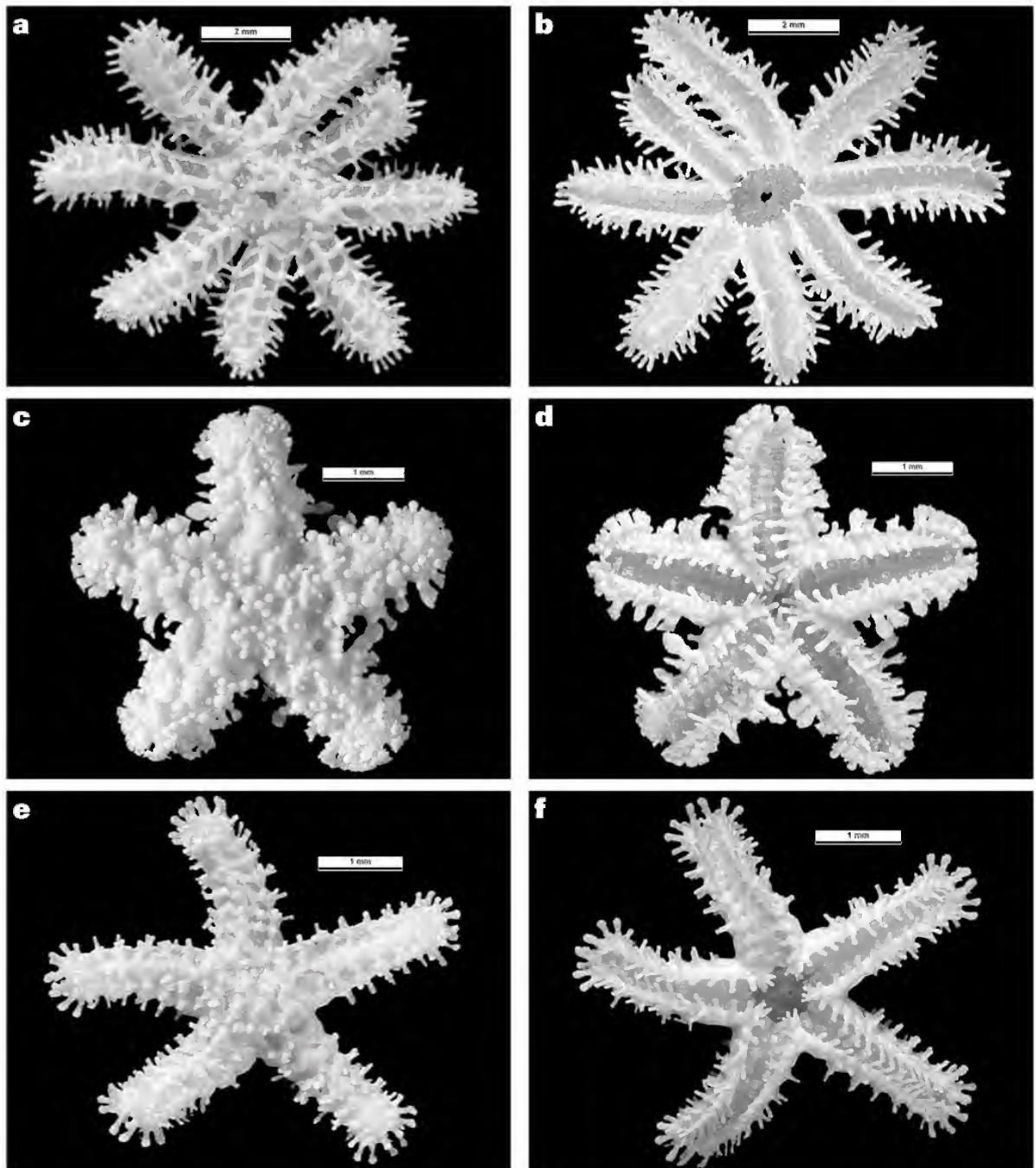


Figure 3. Asteriid species of the rocky shallows of the coast of Victoria. a, b. *Coscinasterias muricata* Verrill (NMV F73314): a, abactinal view showing unequal arm lengths (fissiparous when juvenile), alternating spiniferous and non-spiniferous small carinal plates, and digitiform thin marginal spines; b, actinal view showing 10 arms (2 very small regenerating) of a typically 11 arm species. c, d. *Uniophora granifera* (Lamarck) (NMV F113567): c, abactinal view showing typical 5 equal rays, globose abactinal spinelets, and globose marginal spines; d, actinal view showing globose spines with distinct stem. e, f. *Smilasterias multipara* O'Loughlin and O'Hara (NMV F121895): e, abactinal view showing typical 5 equal rays, digitiform thin marginal spines; f, actinal view.



Figure 4. Livespecimen of *Allostichaster palmula* sp. nov. from 10–12 m at Popes Eye in Port Phillip Bay (NMV F132700; R = 1.2 mm; 5 equal rays at this smallest size; photo by Trevor McMurrich).

convenience under the aegis of *Asterias*". He characterized the family as having usually 5 or 6 rays, 5 primary longitudinal series of plates (carinal, 2 superomarginal, 2 inferomarginal), generally reticulate dorsal skeleton, crowded ambulacral plates, and mostly 2 or 4 longiseries of tube feet. A.M. Clark (1962) characterized the Asteroidea as having: usually 4 series of tube feet, short adambulacral plates, usually straight pedicellariae at least in the furrow, marginal spines not needle-like. Most recently McKnight (2006) diagnosed the family as "Forcipulatida with five or more arms, usually merging into the disc, sometimes more sharply set off from it. Abactinal skeleton reticulate, with longitudinal and transverse series of plates, or reduced to isolated plates, in no apparent order. Skeleton extending to tip of rays, the plates armed with one or more spines or spinelets. Adambulacral plates short, with the spines in a single transverse series, usually one or two, but up to seven may be present. Tube feet in two or four rows". The morphological characters of the asteriid species in this study are in accord with these diagnoses.

Allostichaster Verrill, 1914

Remarks. Verrill (1914) erected his genus for *A. polyplax*, and diagnosed the genus as "diplacanthid and multiple rayed, with one to five madreporic plates, and is probably autotomous. The two rows of marginal plates are stout and imbricated; dorsal plates and spines form five somewhat irregular longitudinal rows, several short, obtuse spines on each plate. Minor pedicellariae are dermal, usually not circumspinal". Fisher (1923) characterized *Allostichaster* as having: carinals and superomarginals broader than other plates; narrow dorsolateral area; fissiparous habit; superomarginal plates with beaded surface. A.M. Clark (1962) noted for *Allostichaster*: rarely as few as 5 arms; fissiparous habit; narrow dorso-lateral area. Most recently McKnight (2006) diagnosed the genus as "Asteroidea with the abactinal crossed pedicellariae scattered, not in circumspinal wreaths; skeleton closeknit, plates in definite longiseries; carinals and superomarginals broader than other plates; adradial plates narrow, in a single straight or zigzag series; inferomarginals form edge to arm; one series of

actinal plates. Adambulacral plates usually diplacanthid; cleaned superomarginal plates with beaded area; multiple madreporites, fissiparous, rays 5–8, often in 2 sizes". We found the morphological characters of *Allostichaster polyplax* to be in accord with these diagnoses.

Allostichaster palmula Benavides-Serrato and O'Loughlin sp. nov.

Figures 1–4, Tables 1, 2.

Material examined. *Allostichaster palmula* Benavides-Serrato and O'Loughlin sp. nov. Holotype: SE Australia, Victoria, E Western Port, San Remo, N of bridge, bank of main channel, shallows, soft sediment or rocky substrate, Marine Research Group of Victoria, 13 Jan 1990, NMV F113585 (dry, 6 arms; disc and 4 arms intact, 1 arm detached and cleared of integument, 1 arm detached uncleared; max R = 2.5 mm, r = 1 mm, R/r = 2.5).

Paratypes: E Victoria, Mallacoota, MSL Abalone Survey, VAC SIQ2, 24 May 1987, F120432 (1, dry, 6 arms, 3 long, 3 very short, whole specimen cleared of integument; max R = 5 mm, r = 1 mm, R/r = 5); N Western Port, WBES Stn 1704, Bouchier Channel, S-M Grab, 12 m, sand, 9 Jan 1974, F87056 (1, dry, 3 arms; disc and 1 arm complete, 2 arms detached; max R = 2.5 mm, r = 0.5 mm, R/r = 5); NW Western Port, between Stony Point and Tankerton, dredge, 12 Nov 1974, F86026 (1, dry, 6 arms; disc with 2 arms complete; 4 detached arms; max R = 3 mm, r = 0.5 mm, R/r = 6); W Western Port, dredged off Cowes, 2–5 m, 1977, F86023 (1, dry, 6 arms; disc and 5 arms complete, 1 arm detached; max R = 4 mm, r = 1 mm, R/r = 4); Port Phillip Bay, Popes Eye, 10–12 m, found eating encrusting bryozoan *Membranipora* on brown alga frond, J. Watson, R. Burn, T. McMurrich, 29 Apr 2007, F132700 (1, alc, 5 arms, max R = 1.2 mm, r = 0.7 mm, R/r = 1.7); 6–10 m, J. Watson, R. Burn, from alga, sponge, hydroid, bryozoa sample, 6 Aug 2006, F113566 (1, dry, 5 arms; disc and 3 arms complete; max R = 2 mm, r = 1 mm, R/r = 2).

Allostichaster polyplax (Müller and Troschel, 1844). Victoria, 1 km E of Harmers Haven, CPA Stn 15, 300 m offshore, off algae, 6 Mar 1982, NMV F120422 (2, alc; 1 with 6 arms, max R = 6 mm, r = 1.5 mm, R/r = 4; 1 with 6 arms, max R = 5.5 mm, r = 2 mm, R/r = 2.75); Western Port, Crib Point Benthic Survey, CPBS Stn 03 S, 2 m, sandy-mud, 13 Apr 1965, F71968 (2, dry; 1 with disc and 3 arms complete, 1 detached, max R = 3 mm, r = 1 mm, R/r = 3; 1 with 6 arms, 3 long, 3 very short, max R = 3 mm, r = 1 mm, R/r = 3); CPBS Stn 12 N, mud and *Zostera*, 16 Apr 1965, F71967 (1, alc, 3 arms, 2 long, 1 very short, max R = 8 mm, r = 1 mm, R/r = 8); CPBS, Stn 10 O, 4 m, mud and *Zostera*, 24 Apr 1965, F71969 (1, dry, 7 arms; max R = 6 mm, r = 1 mm, R/r = 6); Flinders, rocky shallows, 13 Apr 1985, F120423 (1, alc, 5 arms, 3 long, 2 very short, max R = 6 mm, r = 1 mm, R/r = 6); Port Phillip Bay, Environmental Study Benthic Survey, PPBS Stn 953, 3 m, sand, 11 Jun 1971, F71975 (1 dry, 4 arms, 2 detached, max R = 7 mm, r = 1 mm, R/r = 7); Popes Eye, rocky shallows, 30 Nov 1980, F73409 (1, dry, 5 arms, disc and 4 arms complete, max R = 9 mm, r = 3 mm, R/r = 3); Point Cook, shallows, F73405 (2, dry; 1 with 7 arms, 5 long, 2 very short, max R = 9 mm, r = 1 mm, R/r = 9; 1 with 8 arms, max R = 8 mm, r = 2.5 mm, R/r = 3.2); Tasmania, Derwent R. estuary, Opposum Bay, rocky shallows, 15 Nov 1982, F73988 (1, dry, 8 arms, max R = 8 mm, r = 2 mm, R/r = 4).

Coscinasterias muricata Verrill, 1867. Victoria, Point Hicks, subtidal rocky reefs, 10 m, 26 Mar 1996, F113590 (1, dry, 5 arms; max R = 4 mm, r = 1 mm, R/r = 4); Flinders ocean platforms, algal epifauna, 0–2 m, 11 Aug 1990, F72193 (1, dry, integument cleared, 7 arms, 6 long, 1 very short, max R = 7 mm, r = 1 mm, R/r = 7); Port Phillip Bay, Popes Eye, off algae, 30 Nov 1980, F73314 (1, dry, 10 arms, 8 long, 2

very short, max $R = 6$ mm, $r = 1$ mm, $R/r = 6$); Western Australia, Albany, Princess Royal Harbor, 1.6 m, 21 Jan 1988, F121890 (1, alc, 8 arms, max $R = 5$ mm, $r = 1.5$ mm, $R/r = 3.33$).

Smilasterias multipara O'Loughlin and O'Hara, 1990. Victoria, Flinders ocean platforms, rocky shallows, 26 Feb 2000, F121895 (7, alc; 1 dry, 5 arms, max $R = 2.5$ mm, $r = 0.8$ mm, $R/r = 3.13$).

Uniophora granifera (Lamarck, 1816). Victoria, Bunurong, off Cape Paterson, subtidal rocky reefs, 10–11 m, 1 Apr 1997, F113567 (1, dry, 5 arms, max $R = 2$ mm, $r = 1$ mm, $R/r = 2$); South Australia, Rapid Bay jetty, sand, rubble, 12 m, 7 Apr 1980, F126862 (1, dry, 5 arms, max $R = 9$ mm, $r = 2$ mm, $R/r = 4.5$); Smoky Bay, 12 m, sand and weed, 25 Apr 1973, F120434 (1, dry, cleared of integument, max $R = 8$ mm, $r = 2$ mm, $R/r = 4$).

Description. 6 discrete arms, or 5 (2 smallest); arms wide, not tapering, rounded distally, max $R = 5$ mm, $r = 1$ mm, $R/r = 5$ (F120432); 6 specimens show post-fissiparous form, smallest non-fissiparous; madreporites inconspicuous; arms flat actinally, domed abactinally; margin acute, defined by inferomarginal plates; oral plates inconspicuous; abactinal plates thick, imbricate; disc plates irregular in form, imbricate, larger than carinal plates, irregularly arranged; longitudinal regular series of quadrilobed carinal plates, narrowly imbricating longitudinally, imbricating with superomarginal plates laterally; rare small dorso-lateral plates; superomarginal plates largest, regular longitudinal series, plates transversely elongate, proximal lobes narrowly imbricating longitudinally, narrowly imbricating laterally with carinal and inferomarginal plates; papular areas distinct, smaller than plates, 2 longitudinal series between carinal and superomarginal plates; inferomarginal plates longitudinally elongate; lacking actinal plates; adambulacral plates transversely narrow, about 2–3 contiguous with each inferomarginal plate; 2 contiguous proximal adambulacral plates forming adoral corona; tube feet quadriseriate.

About 2–3 spinelets per disc, carinal or superomarginal plate; spinelets widened distally or columnar, coarsely spinous distally; spinelets distributed irregularly over abactinal surface of arms and disc; crossed pedicellariae present abactinally and marginally, smaller than spinelets, not associated with individual spinelets, scattered amongst spinelets; inferomarginal plates predominantly monacanthid, rarely diplacanthid; inferomarginal spines project widely from the margin, each with proximal stem and distal broad flat blade with vertical and radiating ribs, blade distally slightly rounded and strongly serrate; adambulacral plates diplacanthid, single series of subambulacral spines, single series of furrow spines, pairs typically forming a “V”; adambulacral spines subequal, shorter than inferomarginal spines, subclavate, subspatulate, distinctly spinous distally; some straight pedicellariae scattered in furrow, larger than crossed pedicellariae.

Colour (live). Upper proximal rays and disc brown, lower and distal rays white, inferomarginal spines brown.

Distribution. SE Australia, Mallacoota to Port Phillip Bay, sediment, 0–12 m.

Etymology. From the Latin *palmula* (blade of an oar), referring to the distinctive form of the inferomarginal spines.

Remarks. *Allostichaster palmula* shares many diagnostic characters with the other local shallow asteriid species *Allostichaster polyplax*, *Coscinasterias muricata*, *Smilasterias multipara* and *Uniophora granifera*: stellate form with discrete rays; 5 primary longiseries of plates (1 carinal, 2 superomarginal, 2 inferomarginal); abactinal skeleton of transverse arches on arms, forming a network of rectangular or irregular mesh; both series of marginal plates well developed; crossed and straight pedicellariae; tube-feet in 4 longiseries. The diagnostic distinctions between these species are listed in Tables 1 and 2.

Allostichaster palmula and *A. polyplax* share many characters at R up to 6 mm: fissiparity; predominantly 6 rays; large, thick, imbricate abactinal plates; prominent abactinal series of carinal and superomarginal plates; lack dorsolateral and actinal plate series; superomarginals are largest plates; paired longitudinal series of prominent papular spaces abactinally; scattered, distally-widened abactinal spinelets; crossed pedicellariae abactinally; straight pedicellariae in furrow, orally; 2 pairs of post-oral adambulacral plates form adoral corona, with post-oral plates joined along interradiar margins; adambulacral plates diplacanthid, pairs typically forming a “V”, with 2 single series of furrow and subambulacral spines. The diagnostic distinctions between the 2 species are listed in Table 2.

The pedomorphic new species *Allostichaster palmula* exhibits the diagnostic characters of the order Forcipulatida, family Asteriidae, and genus *Allostichaster* referred to above. However, the small specimens do not have actinal plates and madreporite plates were not recognized. As noted above, the marginal plates are conspicuous, and there are no ventrolateral papulae.

For the 3 fissiparous species, R/r ratios vary greatly and reflect the variable regenerating arm lengths following fissiparity: *A. palmula* from 1.7 to 6; *A. polyplax* from 2.8 to 9; *C. muricata* from 3.3 to 7. But with each of these fissiparous species the largest ratio was measured on the largest specimen, suggesting from this limited sample that R/r increases with maximum R . This is true for the 3 specimens of the non-fissiparous *U. granifera*, with R/r increasing from 2 ($R = 2$ mm) to 4.5 ($R = 9$ mm). *A. polyplax* adults have predominantly 8 arms. *C. muricata* adults have predominantly 11 arms. Neither of these maxima was evidenced in specimens below $R = 8$ mm, suggesting that arm number increases with size in these fissiparous species. In the new species *A. palmula* the 2 smallest specimens have only 5 arms, the rest 6 arms. We note that the smallest specimen of *C. muricata* ($R = 4$ mm) has 5 equal arms and does not show evidence of fissiparity, suggesting that fissiparity does not occur until $R > 4$ mm. Likewise the smallest specimen of *A. palmula* ($R = 1.2$ mm) has 5 equal arms and does not show evidence of fissiparity, suggesting that fissiparity does not occur until $R > 1.2$ mm. Other characters are also size-dependent, such as the presence of actinal plates in larger specimens of *A. polyplax*.

O'Loughlin and Rowe (2006) described 2 micro-species of fissiparous Asteriidae, with maximum $R = 5$ mm: *Aquilonastra colemani* from Papua New Guinea and Indonesia, and *Aquilonastra doranae* from Okinawa. *Allostichaster palmula*

is a comparably small-sized micro-asteriid, with maximum $R = 5$ mm. These are the smallest known asteroid species.

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A new species of Colossendeis (Pycnogonida: Colossendeidae) together with records from Australian and New Zealand waters

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Abstract

Staples, D. A. 2007. A new species of Colossendeis (Pycnogonida: Colossendeidae) together with records from Australian and New Zealand waters. *Memoirs of Museum Victoria* 64: 79–94.

Six species of the genus *Colossendeis* Jarzynsky, 1870 and one species of *Hedgpethia* Turpaeva, 1973 are reported from Australian and New Zealand waters; namely *Colossendeis arcuata* Milne-Edwards, 1885, *C. colossea* Wilson, 1881, *C. tasmanica* sp. nov., *C. melancholicus* Stock, 1975, *C. spicula* Child, 1994, *C. mycterismos* Bamber, 2004 and *Hedgpethia dampieri* (Child, 1975). *Colossendeis melancholicus*, *C. spicula* and *C. mycterismos* are recorded from the region for the first time. Diagnoses for each species are provided. Type specimens of *Hedgpethia dampieri* have been re-examined.

Keywords

Pycnogonida, southern Australia, north-west Australia, New Zealand, Colossendeidae, *Colossendeis*, *Hedgpethia*, deep-sea, Tasman Sea, NORFANZ.

Introduction

This paper reports on pycnogonid material belonging to the family Colossendeidae collected from Australian and New Zealand waters, between approximate latitudes of 21°S and 55°S. Although not represented in the collection sites, New Caledonia partly falls within these latitudes and three species from that area are also included. Two genera belonging to this family are represented in this report; *Colossendeis* Jarzynsky, 1870 and *Hedgpethia* Turpaeva, 1973. *Colossendeis* is typically a deep-sea genus that includes the largest pycnogonids, commonly with far-ranging distributions. Because of their size, frequently with leg spans ranging from 40–50 cm, *Colossendeis* is the most conspicuous genus represented in deep-sea trawls. *Colossendeis* was first recorded from the Australian region by Hoek (1881) from *Challenger* station 158 (latitude about 50° S). Clark (1963) and Child (1995) subsequently recorded specimens from the Great Australian Bight, Western Australia and from south of Tasmania respectively. Child (1998) provided an excellent review of the pycnogonid fauna of New Zealand between approximate latitudes of 25°S to 55°S. He documented nine species of *Colossendeis* and described one new species of *Hedgpethia* but appears to have overlooked Fage's (1956) report on the pycnogonids collected by the *Galathea* expedition in which five species of *Colossendeis* from New Zealand waters were recorded. The number of specimens available for study has increased substantially in recent years, reflecting the increased activity in deep-sea research in the region. This report records a further four species of which one is new and three represent

new records. A large number of specimens collectively grouped under the *macerrima* complex of species (Stock, 1978), will be the subject of a separate paper. Deep-sea observations of a *Colossendeis* swimming off the bottom (Grassle et al., 1975), another floating near the bottom (Monod, 1954) and records from bathypelagic samples (Bamber, 2002; Mauchline, 1984) support the probability that distribution of some species is assisted by slow-moving currents found at these depths.

Unlike *Colossendeis*, which may be collected in large numbers, *Hedgpethia* species are usually represented by one or two species from few collecting sites. *Hedgpethia* does not reach the great size of most *Colossendeis*, and although they share a wide depth range, they generally extend into much shallower depths. Three species of *Hedgpethia* are represented from Australia, New Zealand and New Caledonia. This collection is predominantly based on sampling by the Australian Commonwealth Science and Industry Research Organization (CSIRO) vessels RV *Franklin* and RV *Southern Surveyor* from localities in the Tasman Sea, off the New South Wales and Victorian coasts, the east and west coasts of Tasmania, off the South Australian coast and the south and north west Western Australian coast. Specimens were recorded between latitudes 20°55.01'S and 41°54.54'S at depths ranging from 55 m to 2800 m. The NORFANZ voyage material is part of a larger collection by the New Zealand research vessel RV *Tangaroa* in a deep-sea trawling expedition around Norfolk I., Lord Howe I. and northern New Zealand from 10 May to 8 June 2003. The expedition documented the biodiversity of

the marine fauna from seamounts and slopes on the Norfolk Ridge and Lord Howe Rise. A brief diagnosis of species represented in this report together with additional figures, is provided to supplement existing descriptions. Specimens are lodged in the South Australian Museum (SAM); Australian Museum (AM); Museum Victoria (NMV); Tasmanian Museum and Art Galleries (TMAG) and Western Australia Museum (WAM). Duplicate NORFANZ specimens have been lodged in the National Museum of New Zealand, Te Papa (NMNZ).

Species of *Colossendeis* and *Hedgpethia* known from the Australian and New Zealand region

Colossendeis angusta Sars, 1877

Colossendeis arcuata Milne-Edwards, 1885

Colossendeis australis Hodgson, 1907

Colossendeis bruuni Fage, 1956

Colossendeis colossea Wilson, 1881

Colossendeis cucurbita Cole, 1909

Colossendeis drakei Calman, 1915

Colossendeis hoeki Gordon, 1944

Colossendeis longirostris Gordon, 1938

Colossendeis macerrima Wilson, 1881

Colossendeis media Hoek, 1881

Colossendeis megalonyx Hoek, 1881

Colossendeis melanocholicus Stock, 1975

Colossendeis minor Schimkewitsch, 1893

Colossendeis mycterismos Bamber, 2004

Colossendeis pipetta Stock, 1991

Colossendeis sinuosa, Stock, 1997

Colossendeis spicula Child, 1994

Colossendeis tasmanica sp. nov.

Colossendeis tortipalpis Gordon, 1932

Hedgpethia dampieri (Child, 1975)

Hedgpethia eleommata Child, 1998

Hedgpethia tibialis Stock, 1991:166

Colossendeidae Hoek, 1881

Diagnosis. Trunk and legs typically glabrous. Lateral processes short, either clearly separated or crowded. Proboscis long, typically longer than trunk. Chelifores present or absent in adults. Palps 10-segmented (one species with 9 segments), basal segments 1 and 2 very short. Ovigera 10-segmented, terminal claw strong, strigilis well-formed. Legs long, 4, 5 or 6 pairs, auxiliary claws absent.

Colossendeis Jarzynsky, 1870

Diagnosis. Specimens often large; trunk unsegmented, smooth (very rarely with spines), tubercles or ridges absent; lateral processes usually clearly separated. Abdomen well-developed, usually articulated at base. Ocular tubercle low, rounded or

conical, sometimes terminally acute; 2–4 eyes present, or absent. Chelifores absent in adults. Palps and ovigera touching at bases; strigilis tightly curved, terminal claw strong. 4 pairs of legs, large propodal heel spines absent, main claw long or short, genital pores tiny. Sexual dimorphism little understood.

Remarks. Pale areas principally defined by a change of texture of the integument, are present on the dorsal surface of the 2nd coxa of all legs of most species. These areas are comprised of thinner cuticle and are either flat or blister-like (fig. 7B). Provisionally referred to as coxal glands (Staples, 2002: 541), the term coxal pellicula (= filmy protective covering) is now used to avoid implying a function and purpose which has not been established. Similar areas have also been noted in *Pentapycnon* (Bouvier, 1913) and *Pycnogonum* (Flynn, 1919). In some instances they resemble large genital pores and probably represent what Stiboy-Risch (1993) described and illustrated as dorsal genital openings in *C. glacialis* Hodgson, 1907, *C. arcuata* Stiboy-Risch, 1993 and *C. robusta* Hoek, 1881. As far as I am aware, the genital pores of all *Colossendeis* are placed ventrally on the 2nd coxae of some, or all legs. A single gland opening on the outer surface of palp segment 5 and the ecto-posterior surface of ovigera segment 4 is present in most species.

Colossendeis arcuata A. Milne-Edwards, 1885

Figures 1A–J, 7C, D.

Colossendeis arcuatus A. Milne-Edwards, in Filhol, 1885:151, fig. 48.

Colossendeis arcuata Stock, 1978: 403–405, fig. 1g–j [earlier synonymy]; Stock, 1986: 417–Bamber, 1983: 71–72, fig. 5; Bamber, 2004, 6–Child, 1992: 41; Child, 1998, 56–Bamber and Thurston, 1993: 859; Bamber and Thurston, 1995:143–45, fig. 9E.

Material examined. South Australia. Investigator Group, approx 75 n miles SSW of Pearson I., 35°08'S, 132°47'E, 1000 m, trawled, 1989, SAM E3383 (1 specimen). Approx 100 n miles SSE of Cape de Covedic, Kangaroo I., 37°S, 137°E, 900–1000 m, trawled, FV *Comet*, G. Newton, 14–8 Feb 1988, SAM E3384 (1 specimen). Approx. 120 n miles SW of Cape Adieu, Great Australian Bight, 33°58'S, 131°22'E, 1000 m, trawled, FV *Saxon Progress*, P. Wheenan, Nov 1989, SAM E3385 (1 specimen). Due SW of Kangaroo I., approx. 36°10'S, 135°45'E, 1060 m, 'orange roughly' trawl, G. Newton, July 1988, SAM E3387 (1 specimen). Western Australia. Approx. 11 n miles due S of Eucla, Great Australian Bight, 33°31'S, 128°49'E, 1059–1914 m, FV *Longva* 111, K. Gowlett-Holmes, 10 Dec 1989, SAM E3386 (1 specimen).

Diagnosis. A large, robust species. Trunk and proboscis covered in tiny but mostly inconspicuous, spinules. Ocular tubercle lowly conical in lateral view, two large eyes on the sloping anterior surface, unpigmented in preserved material. Proboscis 1.25–1.50 times length of the trunk, robust, down-curved throughout its length. Abdomen clavate, articulated with trunk. Palp segment 3 longest, segment 5 less than half length segment 3, distal segments characteristically doubly-recurved. Oviger claw linear, gently curved. Legs; tarsus about three-quarters length of propodus, claw less than one quarter propodus length.

Distribution. Cosmopolitan. Depth 730–2177 m.

Type locality. W of Moroccan Coast.

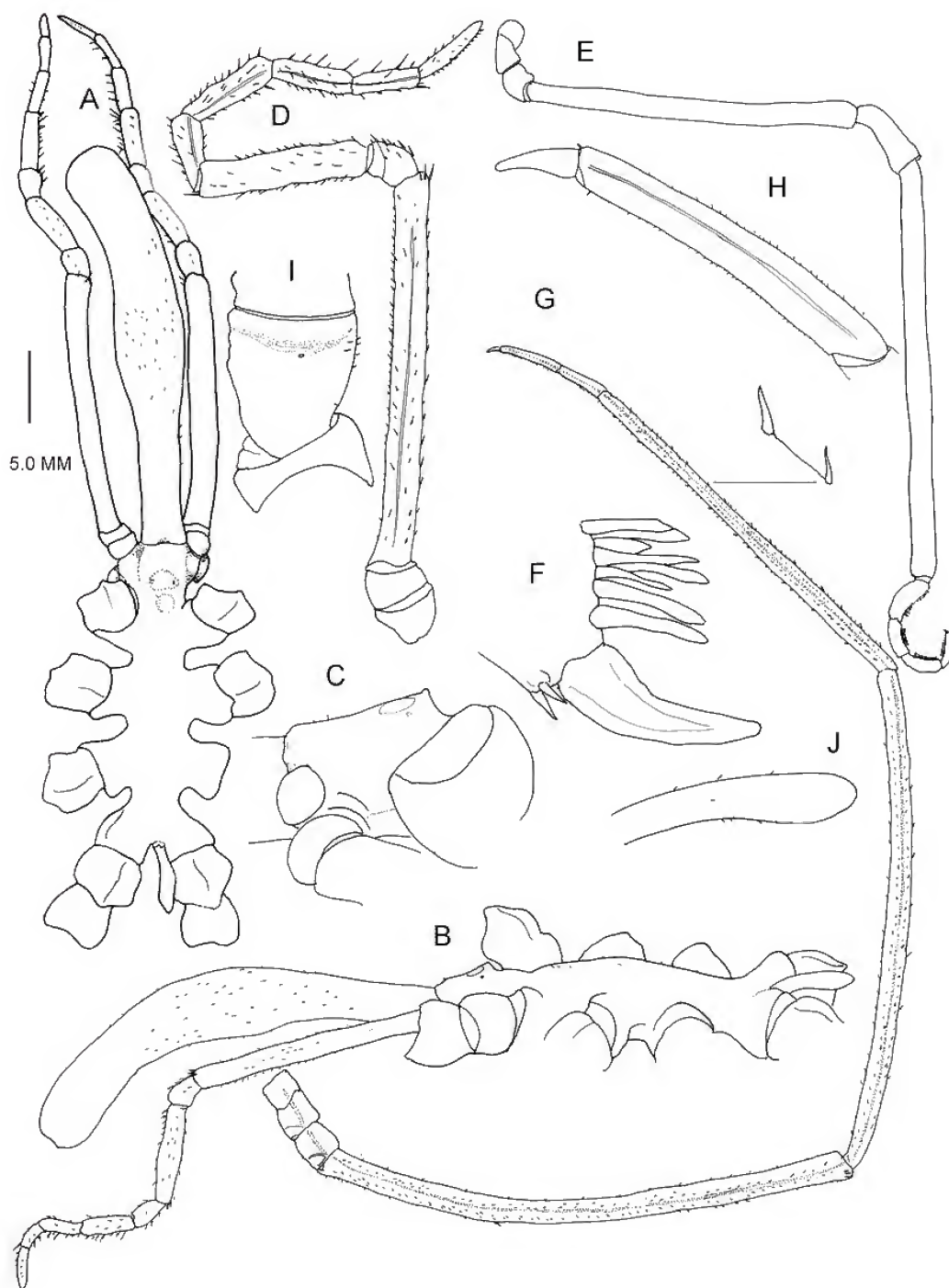


Figure 1. *Colossendeis arcuata* (SAM E3384): A, B, trunk, dorsal and ventral views of trunk; C, cephalon, lateral; D, palp; E, oviger; F, oviger claw; G, leg 3; H, propodus and claw; I, coxa 2 and genital pore; (SAM E3383); J, abdomen.

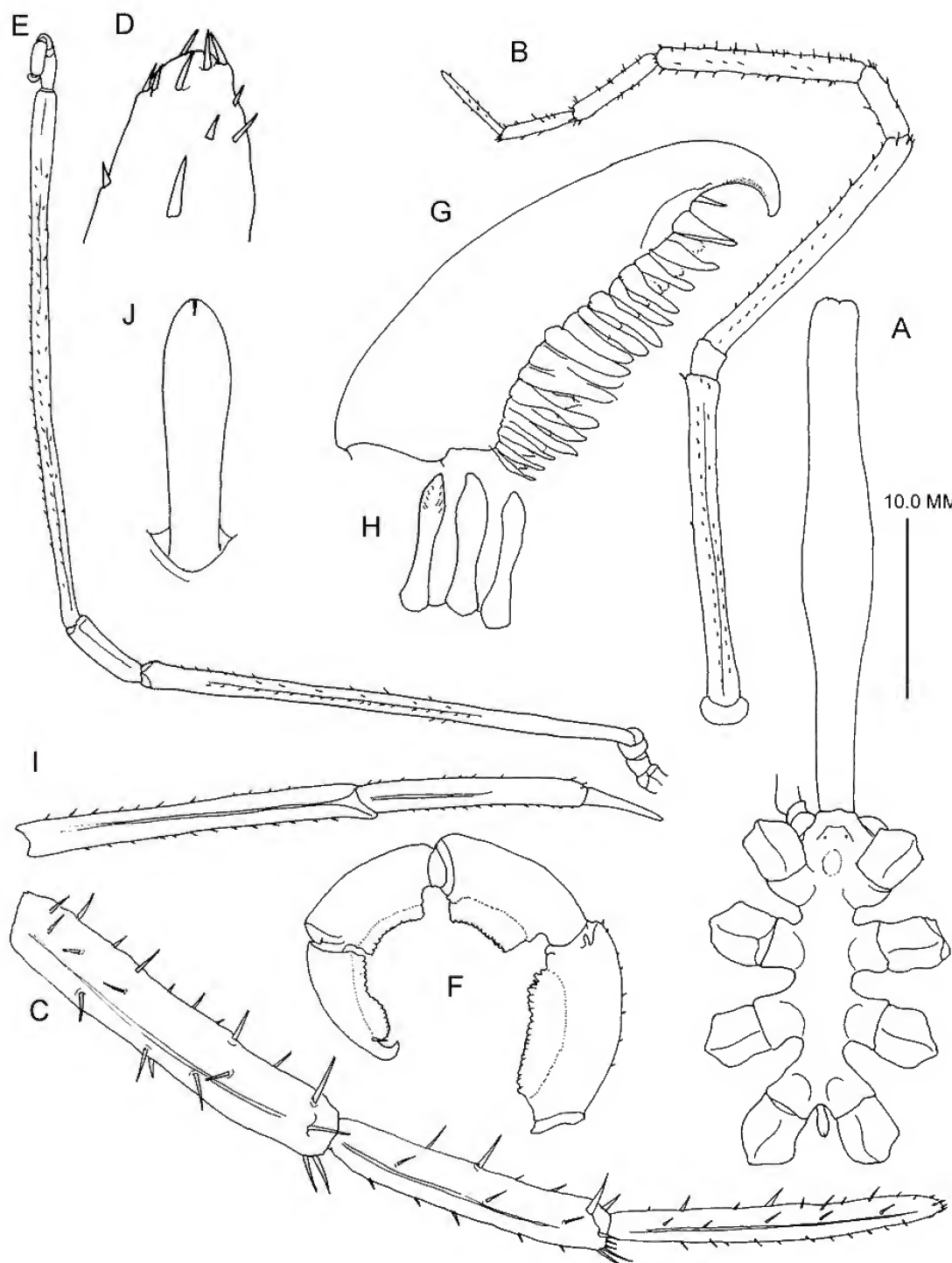


Figure 2. *Colossendeis colossea* (NMV J40745): A, dorsal view of trunk; B, palp; C, palp segments 8 to 10; D, tip, palp segment 10; E, oviger; F, oviger segments 7–10; G, oviger segment 10; H, oviger spines; I, tarsus and propodus leg 3; J, abdomen, dorsal.

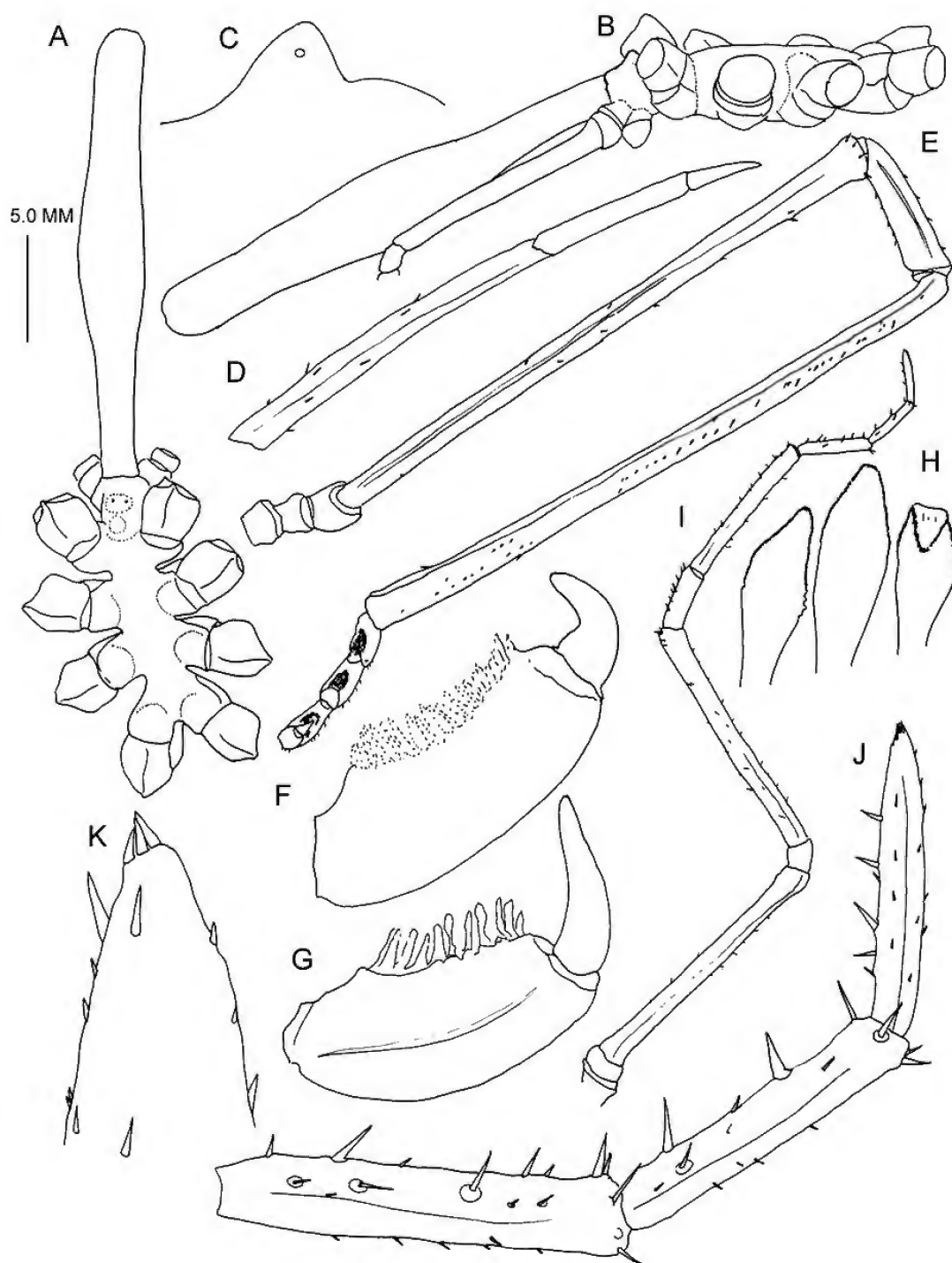


Figure 3. *Colossendeis tasmanica* (J48897): A, B, dorsal and lateral views of trunk; C, ocular tubercle; D, tarsus and propodus; E, oviger; F, oviger segment 10; G, (J40744), juvenile oviger segment 10; H, oviger spines; I, palp; J, palp segments 8–10; K, tip, palp segment 10.

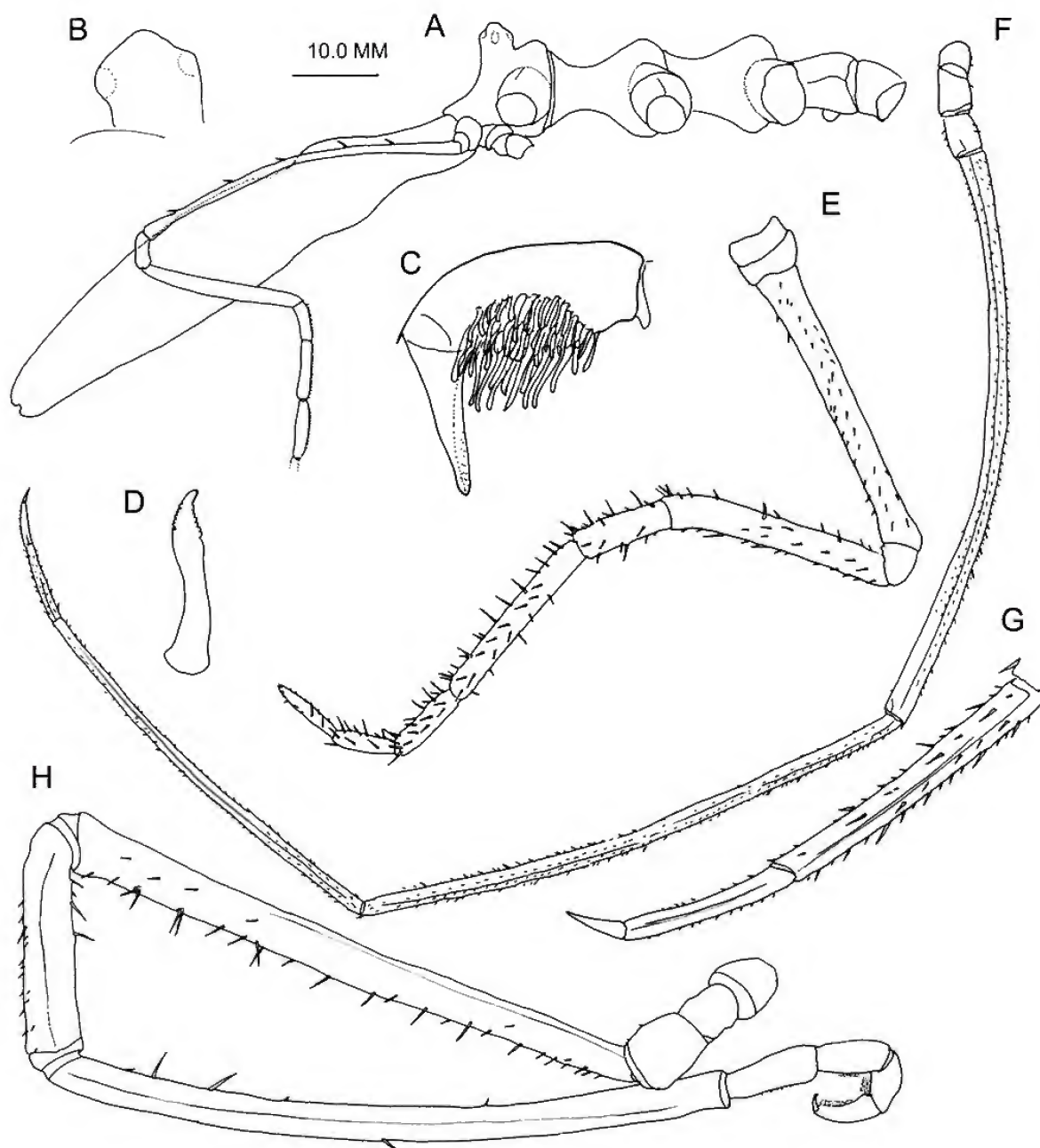


Figure 4. *Hedgpethia dampieri* Child, 1975 (NMV J48903): A, Trunk, lateral view; B, ocular tubercle; C, oviger segment 10; holotype (WAM 70-3953) D, oviger spine. *Colossendeis spicula* (NMV J54504): E, palp; F, leg 2; G, tarsus and propodus; H, oviger.

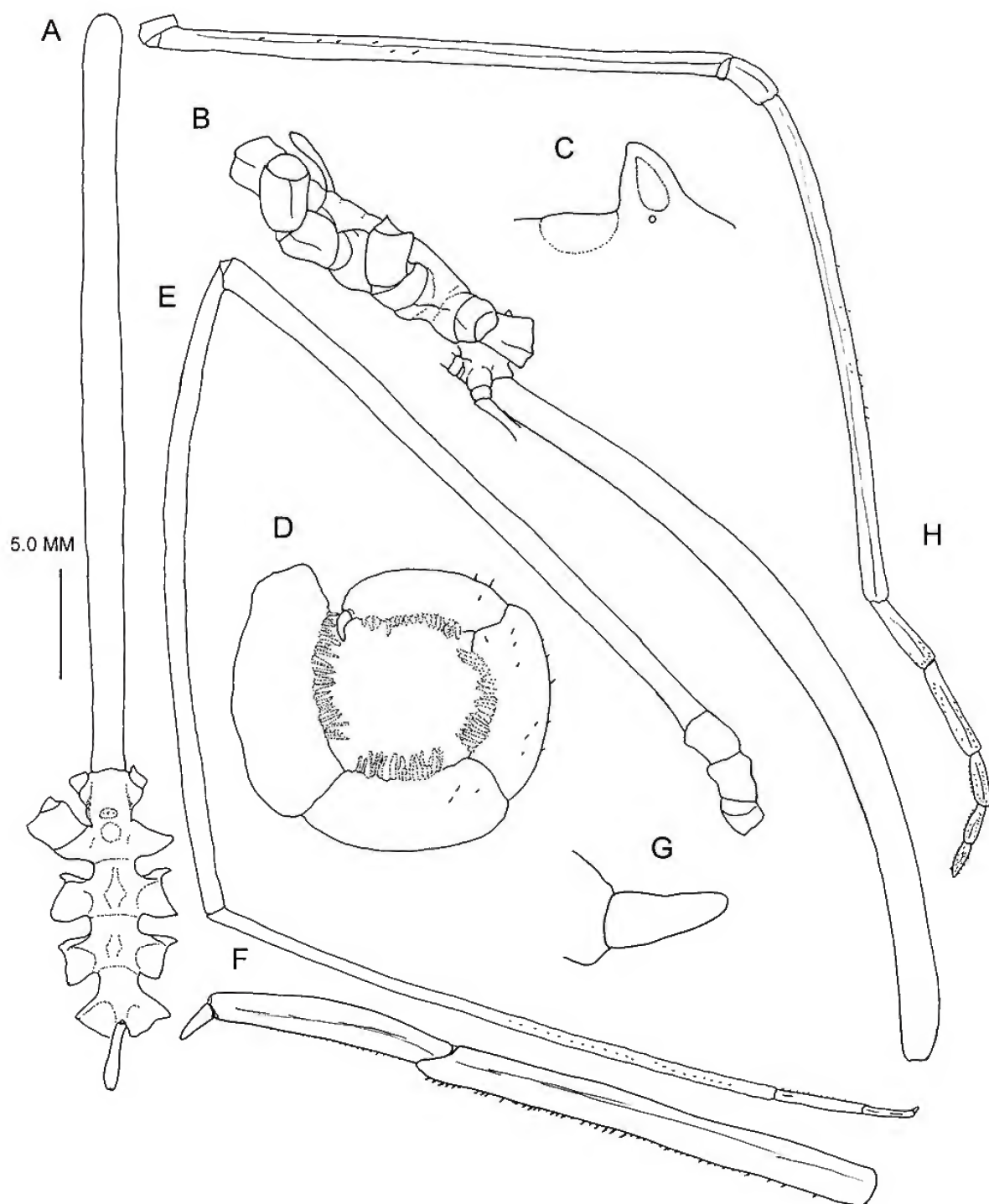


Figure 5. *Colossendeis melancholicus* (NMV J48898): A, B, dorsal and lateral views of trunk; C, ocular tubercle; D, oviger segments 7–10; E, leg 2; F, tarsus and propodus leg 2; G, claw; H, palp.

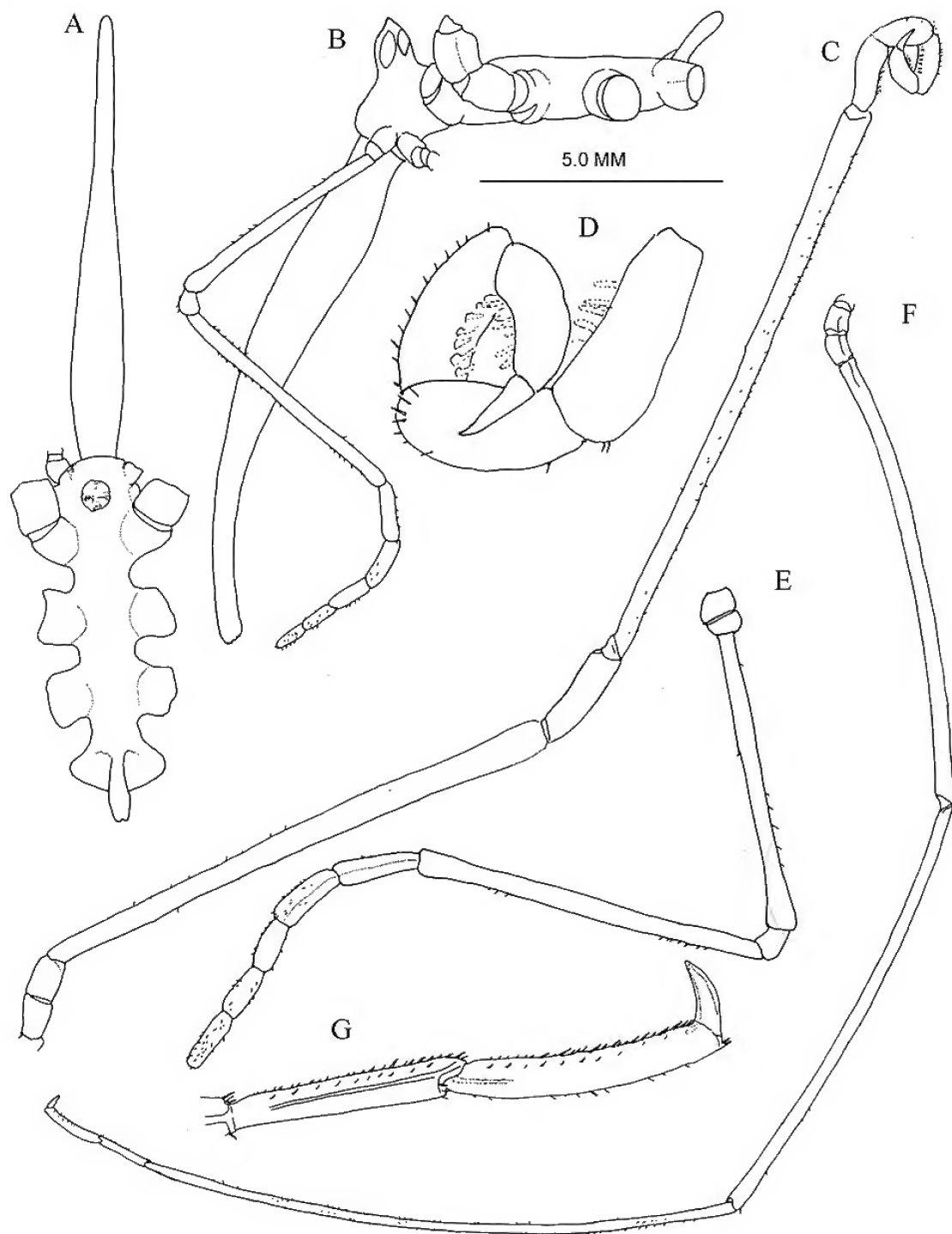


Figure 6. *Colossendeis mycterismos* sp. nov. holotype (NMV J48824): A, B, dorsal and lateral views of trunk; C, oviger; D, oviger segments 7–10; E, palp; F, leg 3; G, tarsus and propodus.

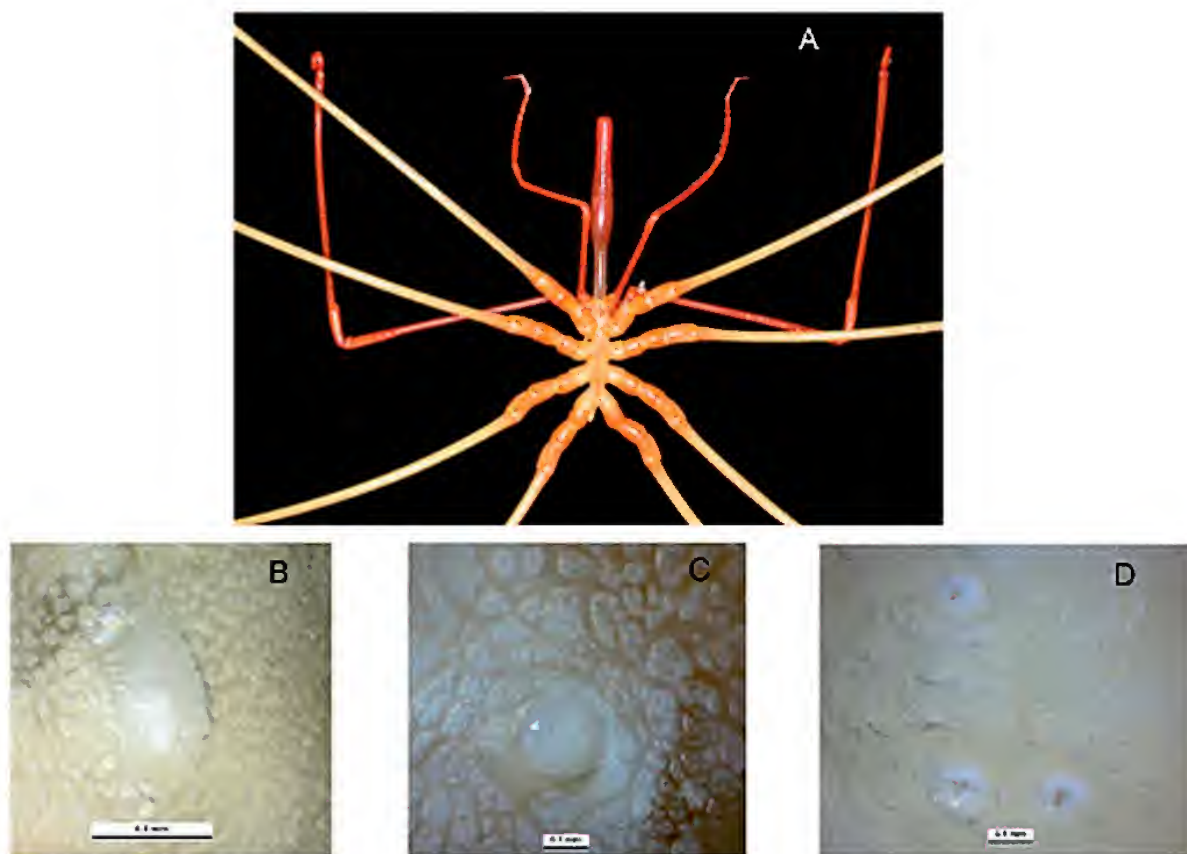


Figure 7. A. *Colossendeis colossea*, dorsal (Photo Gowlett-Holmes, CSIRO) B. *Colossendeis melancholicus*. (J40746), coxal pellicula. (Photo D.A. Staples) C. *Colossendeis arcuata* (SAM E3383) genital pore, leg 3. D. *Colossendeis arcuata* (SAM E3383) sensory setae, oral surface. (Photos D.A. Staples)

Remarks. These specimens agree in all respects with previous observations. Scattered cone-shaped pits each with a single median spine surround the oral surface and presumably serve a sensory function (fig. 7D). The down-curved proboscis of this species resembles *C. rostrata* Turpaeva, 1994 from which it otherwise differs in the proportions of palp segments 3 and 5 and by having the trunk and legs covered in small spines; the slightly taller spines on the leg segments are interspaced by 5–7 shorter spines. The leg span is about 400 mm. Coxal pelliculae are present on all legs. Genital pores (fig. 7C) tiny, round, on distoventral surface of coxa 2 of all legs.

This is the first record for Australian waters, although it has been recorded from nearby New Zealand (Child, 1998).

Colossendeis colossea Wilson, 1881

Figures 2A–J, 7A, Table 1.

Colossendeis colossea Wilson, 1881: 224–246, pl.1, fig. 1, pl. 3, figs 5–7—Fry and Hedgpeth 1969: 53–54 [earlier literature], fig. 8—Stock, 1975: 987; Stock, 1987: 508 (literature)—Bamber and Thurston,

1993: 859; Bamber and Thurston, 1995: 143–144, 147—Child, 1994: 10–11; Child, 1995: 76; Child, 1998: 56–57—Bamber, 1995: 147.

Material examined. Western Australia. 80 km WNW of Green Head, from 29°51.9'S, 114°11.6'E, bottom 770 m, to 29°50.3'S, 114°10.9'E, bottom 760 m, Western Deep-Water trawl, RV *Southern Surveyor*, M. F. Gomon and CSIRO, 7 Feb 1991 (SSO1/1991 stn 62), NMV J40745 (2 specimens). NW Australia, 20°95.01'S, 114°01.58'E to 20°98.82'S, 113°99.38'E, 1018 m, Benthic Dredge, RV *Southern Surveyor*, CSIRO, 9 Jun 2007, (SS05/07 stn 002), NMV J55743 (1 specimen). NORFANZ Lord Howe Rise, 32°03.98'S, 159°52.80'E, 1934 m, Ratcatcher bottom trawl, 24 May 2003, (Tan 0308, stn 071), NMV J48818 (1 specimen). West Norfolk Rise, Wanganella Bank, 35°35.83'S, 169°33.43'E, 1760 m, Ratcatcher bottom trawl, 5 Jun 2003, (Tan 0308, stn 167), NMV J53079 (4 specimens). Lord Howe Plateau, 32°25.94'S, 161°47.62'E, 1132 m to 32°25.08'E, 161°44.31'S, 1197 m, Ratcatcher bottom trawl, 24 May 2003, (Tan 0308, stn 73), MNZ PY.55 (2 specimens). South Australia. Approx 80 n miles SW of Cape du Covedic, Kangaroo I. from 36°38'S, 137°08.20'E, to 36°30'S, 137°20'E, 1000–1200 m, trawled, FV *Adelaide Pearl*, K.J. Olsson, Aug 1988, SAM E3389 (2 fragmented specimens). Tasmania. E of Piccaninny Point, Tasman Sea, 41°40'S, 148°41'E, 1097 m, amongst orange roughly haul, FV *Pacific Dynasty*, (no date), AM P6111 (1 specimen).

Diagnosis based on specimens in this collection: A large species. Trunk smooth, unsegmented, lateral processes clearly separated. Proboscis straight, bottle-shaped, 1.7–1.9 times length of trunk, 5.8–6.8 times as long as greatest width, basal third narrowest, mid-region swollen, slightly tapering to 1.1–1.4 times basal width at tip. Abdomen articulated, clavate, 13–18% of trunk length. Palp segment 3 longest, segment 10 very slender, length 7.5–9.3 times median width, tapering evenly to rounded tip. Ovipiger claw and segment 10 coalesced; length of segment 10, 4.3–5.2 times distal width and conspicuously tapered to form a continuum with terminal claw.

Expanded description based on specimens in this collection. First lateral processes inclined and the cephalon angled downwards at about 45°. 2nd and 3rd lateral processes separated by one-quarter to one-third basal widths. Post-ocular mound low and lacking the internal tubules found in the surrounding cuticle. Two eyes unpigmented in preserved material. Ocular tubercle variable, either conical or broad in anterior view, with or without small mid-dorsal papilla; lateral sensory organs well-defined. Palp segment 3, 1.1–1.2 times as long as segment 5; segment 7 about twice segment 6, 1.9–2.1 times segment 8; segment 8, 1.1–1.4 times as long as segment 9; segment 10, 1.0–1.4 times length of segment 9, segment 10 with 3 to 4 forward-facing spines, segments 7–9 more spinous than remaining segments. Segment 5 has a single gland on external surface. Ovipiger segment 6 longest, about 1.1 times as long as next longest, segment 4; segment 4 has a single gland opening at about 75% of its length, segments 4–6 with scattered small, simple spines, distal four segments each bearing a dense field of long spines on the raised sole of each segment, spines spatulate, some with faint marginal serrations and obscure crenulation; terminal claw hooked, slightly skewed. Legs about 12 times length of trunk. Femur gently curved, 35–38 times as long as distal width, femur and tibia 1 subequal, tibia 1 about 22% longer than tibia 2, the tarsus is 1.7–2.3 times as long as the propodus and the claw 47–61% of the propodal length. Genital pores are on the proximal surface of a low distoventral transverse ridge on legs 3 and 4; those of some specimens about half the size of larger pores, possibly indicating sexual dimorphism. Coxal pellicula present on the dorsal surface of coxa 2 of all legs.

Distribution. A cosmopolitan deep-sea species. Regional records from Campbell Plateau, SE of Bounty Is; Lord Howe Rise and Raukumara plain, E of North Island New Zealand. East, south and west coasts of Australia. Rarely recorded south of the Antarctic convergence. Depth, 647–5219 m.

Type locality. Eastern coast United States, (Blake stn 307, 41°29.45'N, 65°47.10'W).

Remarks. These specimens ranged in size from 255 to 530 mm and agree in all significant respects with Wilson's description of the holotype. In the light of this material, additional observations of intraspecific variability are noted. The distal 3 palp segments are usually recorded as being subequal, whereas in this material there are consistent but small differences. In the absence of a segmentation line separating the ovipiger claw from segment 10, the length of the segment is measured from the basal margin of the segment, to the distal end of the spine

field and the width of the segment from the outer margin of the segment to the same point at the base of the spines. In life (specimen NMV J55743), the trunk and longer leg segments were generally a straw-colour; the proboscis, palps and ovigers a deep orange-red; the ocular tubercle, coxae and propodi of a lighter shade. The proboscis was almost blood red when the specimen was first retrieved but soon changed to match the palps and ovigers (fig. 7A). In contrast to preserved specimens with unpigmented eyes, the eyes were highly reflective, possibly luminescent. Hedgpeth's (1948: 272) observation of the species being bright orange-scarlet in life may be a generalization or indicate intraspecific colour variation.

Colossendeis tasmanica sp. nov.

Figures 3A–H, Table 1

Material examined. Holotype: Tasmania, E of Furneaux Group from 39°48.27'S, 149°06.02'E 1923 m, to 39°47.06'S, 149°05.19'E, 1962 m, McKenna Market trawl. RV *Southern Surveyor*, CSIRO, 29 Apr 2000 (SS01/00 stn 260), NMV J55741.

Paratypes: Details as for holotype, NMV J55742 (4 specimens).

Other material. New South Wales. 67 km ENE of Nowra, from 34°41.97'S, 151°22.44'E, 1896 m, to 34°42.14'S, 151°21.72'E, 1642 m, 3.5 m beam trawl, RV *Franklin*, G.C.B. Poore et al., 22 Oct 1988 (stn Slope 59), NMV J54503 (3 specimens). Off Nowra, from 34°58.40'S, 151°23.20'E, bottom 1750 m, to 34°56.40'S, 151°29.10'E, bottom 1650 m to 1750 m, trawl, 5 m Otter, RV *Franklin*, M.F. Gomom et al., 16 Jul 1986 (stn Slope 15), NMV J40746 (2 specimen). 100 km ENE Nowra, from 34°34.43'S, 151°40.82'E, 2800 m, to 34°34.45'S, 151°39.89'E, 2700 m, trawl, 3.5 beam, RV *Franklin*, G.C.B. Poore et al., 23 Oct 1988 (stn Slope 60), NMV J40742 (2 specimens). Tasmania. E of Furneaux Group from 39°48.27'S, 149°06.02'E 1923 m, to 39°47.06'S, 149°05.19'E, 1962 m, McKenna Market trawl, RV *Southern Surveyor*, CSIRO, 29 Apr 2000 (SS01/00 stn 260), NMV J48897 (30 specimens). E of Furneaux Group from 39°48.27'S, 149°06.02'E 1923 m, to 39°47.06'S, 149°05.19'E, 1962m, McKenna Market trawl, RV *Southern Surveyor*, CSIRO, 29 Apr 2000 (SS01/00 stn 260), MNZ PY.56 (2 specimens). 41 km NE of Cape Tourville, Freycinet Peninsula, from 41°54.54'S, 148°45.15'E, 1273 m, to 41°42.60'S, 148°42.60'E, 1190 m, trawl, 3.5 beam, RV *Franklin*, G.C.B. Poore et al., 30 Oct 1988, (stn Slope 83), NMV J40743 (1 specimen). Victoria. 85 km E of Point Hicks from 38°31.41'S, 149°21.10'E, 1986 m, to 38°30.58'S, 149°21.50'E 1360 m, 3.5 m beam trawl, RV *Franklin*, G.C.B. Poore et al., 26 Oct 1988, (stn Slope 72) NMV J40744, (18 specimens). 38°30.66'S, 149°22.99'E to 38°30.89'S, 149°21.63'E, 1859 m, Epibenthic sled, RV *Southern Surveyor*, CSIRO, 19 Apr 2000, (SS01/00 stn 172), NMV J48899 (4 specimens).

Diagnosis. A large species. *Colossendeis colosseae*-like. Lateral processes clearly separated. Proboscis bottle-shaped, 1.7–2.0 times length of trunk, straight, median swelling preceded by narrower basal part and tapering distally to terminate in a rounded oral surface. Abdomen articulated, maximum width in distal one-third, length 19–29 % of trunk. Palp segment 3 longest, segment 10, 6.3–7.4 times as long as median width. Ovipiger 10-segmented, terminal claw strongly curved, distinctly articulated with segment 10, segment 10 not tapered distally.

Description of holotype. (Range of variability in brackets). Leg span up to about 550 mm (400–550 mm). 2nd and 3rd lateral processes separated by about one-sixth of basal width (one-sixth

to greater than half). Cephalon directed downwards slightly. Ocular tubercle bluntly conical with apical papilla (bluntly conical or broad in anterior view, mid-dorsal papilla variably developed), 2 well-developed eyes, unpigmented in preserved specimen, lateral sensory organs prominent; post-ocular mound low. Abdomen originating from lateral surface between 4th pair of legs, length 21% (19–29%) of trunk, clavate, anus on dorsodistal surface. Proboscis 2.0 (1.7–2.0) times length of trunk and 6.4 (6.1–6.8) times as long as maximum width (subadults about 7.2 times), straight, median swelling preceded by narrower basal part and tapering distally to terminate in a rounded oral surface, width at tip 1.3 (1.2–1.4) times basal diameter. Ovipiger 10-segmented, terminal ovipiger claw hooked and distinctly articulated with segment 10; proximal and distal widths of segment 10 about equal, length 3.4 (2.5–3.5) times distal width (measured from outer margin to base of spines); strigilis strong, carried somewhat horizontally with claw resting against outer, or lower, side of segment 10; spine fields on segments 7–10 dense, trailing edge spines longer, laid-back, individual spines each with fine marginal serrations, particularly evident in subadults (fig. 3H), scattered, short, simple, spines on longer segments; segment 6 marginally longer than segment 4 (equal to 1.1 times), single gland opening on interior surface of segment 4 at about 75% of length. Palp segment 3, 1.2 times longer than segment 5 (1.0–1.2); segment 7, 2.4 times segment 6 (2.2–2.5); segment 10 narrowing markedly towards tip, slightly irregular distally with a slight to marked constriction, length 7.3 (6.3–7.4) times median width, with 3 to 4, forward-facing spines at the tip (fig. 3K) and 2–4 strong spines on inner and ventral margins, smaller spines all over; spines most abundant on segments 7 and 8; single gland openings on outside surface of segment 5. Leg length 12.2 (9.3–12.2) times trunk, longer segments with scattered, short spines, femur curved, 25–33 times as long as distal width, equal to, or a little longer than tibia 1; tibia 1 about 25% longer than tibia 2, tarsus 1.7–2.8 times propodus; terminal claw 40–72% length of propodus; coxal pelliculae are present on the dorsal surface of coxa 2 of all legs in adult forms, absent or not evident in subadults; genital pores on the proximal surface of a low distoventral transverse ridge on legs 3 and 4.

Measurements of holotype (in mm). Length trunk (frontal margin cephalic segment to tip 4th lateral process), 21.5; width

across 2nd lateral processes, 11.0; length proboscis (lateral) 42.0; greatest width proboscis, 6.6; length abdomen, 4.5. Third leg: coxa 1, 3.1; coxa 2, 5.3; coxa 3, 5.3; femur, 86.0; tibia 1, 86.0; tibia 2, 68.0; tarsus, 5.5; propodus, 3.5; claw, 1.5. Measurement of palp segments (in mm). Seg. 1, 1.3; seg. 2, 0.8; seg. 3, 13.1; seg. 4, 2.1; seg. 5, 16.7; seg. 6, 4.2; seg. 7, 10.1; seg. 8, 4.6; seg. 9, 3.9; seg. 10, 4.1.

Etymology. Referring to the collection locality, the Tasman Sea.

Distribution. East coast of Australia; off the coast of Portugal, 1190–2800 m depth.

Remarks. This species shares much in common with *C. colossea* but constant and conspicuous differences in the articulation of the ovipiger claw, the less tapered ovipiger segment 10, the proportions of the abdomen and the longer, more slender palp segment 10, distinguish the species (Table 1).

Size differences of genital pores were noted between specimens. The smaller pores were about half the size of the larger, but based on this difference alone, specimens could not be assigned to sex with confidence. To some extent, the size of these pores is proportionate to the size of the specimen and in the apparent absence of other dimorphism, sex is uncertain. The abdomen shows slight variability; in some cases more narrowed distally than in others. Leg spans of subadults were in the range of 290–350 mm. The ovipiger claw is straight to slightly curved and palp segment 10 is much shorter than in adults, the length ranging from about 4 times median width. Articulation of the ovipiger claw with segment 10 is constant, but the shape of the claw and the proportions of palp segment 10 are unquestionably correlated with maturity. To enable comparison with *C. colossea*, the length of ovipiger segment 10 is measured from the proximal margin of the segment to the distal edge of the spine field rather than to the point of articulation with the claw. The width of the segment is measured from the outer margin of the segment to the base of the spines. The particularly fine serrations of the ovipiger spines in subadults is perhaps indicative of a lack of wear and the spines are very thin, so much so, that the tip of several spines were folded over (fig. 3H). Although not a constant character, the first lateral processes were less inclined and directed more forward than in *C. colossea*.

Table 1. Primary characters distinguishing *C. colossea* and *C. tasmanica*.

	<i>C. colossea</i>	<i>C. tasmanica</i>
Ovipiger claw	Coalesced	Segmented
Ovipiger segment 10	Tapered distally	Uniform width
Ovipiger segment 10, L/W	4.3–5.2	2.5–3.5
Palp segment 10, L/W	7.5–9.3	6.1–7.8
Palp segment 10, distal	Uniformly rounded	Irregular, narrowed
Abdomen/trunk	13–18% (<20%)	19–29% (>20%)

Colossendeis tasmanica is found sympatric with *C. colossea* in the Tasman Sea although of the 75 specimens documented in this report, the two species were never recorded together from the same collection site. Regional records of *C. tasmanica* are confined to the eastern coastline, whereas *C. colossea* is more widely spread around the Australian continent and elsewhere. Nogueira, (1967) recorded and illustrated what appears to be a juvenile *C. tasmanica* from a similar depth to the Tasman Sea specimens off the coast of Portugal, confirming the probability that records of *C. tasmanica* lie unrecognised amongst collections of *C. colossea*. Regional records of *C. tasmanica* are from a greater depth than those for *C. colossea*. This species also shares a resemblance to *C. curcubita* (Cole, 1909), previously recorded in the region from New Zealand and south of Australia. *Colossendeis cucurbita* can be readily distinguished from *C. tasmanica* by the shape of the terminal oviger claw and the proportions of the palp segments. *Colossendeis cucurbita* is a member of the 'macerrima complex' a group characterized by having palp segment 3 much shorter than 5 and in which the three distal most segments are equal to, or less than, segment 7. Based on Cole's illustration of the holotype (pl. 3, fig. 7), the proboscis is more upturned and wider distally than *C. tasmanica*.

Encapsulated juvenile gastropods were attached to the legs of several specimens of *C. tasmanica* and in one case, to the trunk and proximal palp segments. Most capsules contain a single gastropod and many had been vacated. This apparent phoretic association with the genus *Colossendeis* is common and although not evidenced in this material, may extend to being symbiotic or ectoparasitic (Sirenko, 2000; Lehmann et al. 2006). Two deep-water species of stalked barnacle were recorded primarily on the dorsal surfaces of the trunks and legs of several specimens. *Glyptelasma carinatum* (Hoek, 1883) is a cosmopolitan barnacle species previously recorded from the Challenger Plateau, Tasman Sea and the other species, tentatively placed in *Catherinum* sp. cf. *sinuatum* (Pilsbry, 1907), is a deep-water Atlantic species (J. Buckeridge pers. com.).

Colossendeis spicula Child, 1994

Figure 4E–H

Colossendeis spicula Child, 1994: 14. Fig. 6 (A–B)

Material examined. Victoria. 85 km S of Point Hicks 38°31.41'S, 149°21.10'E, 1986 m, to 38°30.58'S, 149°21.50'E, 1360 m, 3.5 Beam trawl, RV *Franklin*, G.C.B. Poore et al., 26 Oct 1988 (stn SLOPE 72), NMV J54504 (3 specimens).

Diagnosis. Leg span to about 285 mm. Lateral processes shorter than their diameters, fringed distally with a few scattered, short, spines; 2nd and 3rd lateral processes separated by about one-third basal widths, 1st pair not conspicuously raised. Anterior margin of cephalon with pair of small but prominent apophyses over base of palp insertions. Ocular tubercle low, two eyes, unpigmented. Proximal quarter of proboscis narrow, inflated in mid-region, tapering distally to a rounded tip, width marginally less than basal diameter. Palps conspicuously spiny, segment 3, 1.4 times segment 5; segment 7 greater than twice length of segment 6. Abdomen articulated, clavate, little less than 30% of

trunk length. Oviger 10-segmented, terminal claw gently curved and articulated with segment 10. Legs about 9 times length of trunk; femur marginally longer than tibia 1; tibia 1, 1.3 times tibia 2. Tarsus 1.8 times propodus, claw 36% of propodus. Spines in rows, straight or curved slightly, longer spines equal to, or longer than width of segment.

Distribution. West and east Pacific (Tasman Sea and off the Oregon coast), Depth 1360–2832 m.

Type locality. Off the Oregon coast, USA.

Remarks. This collection consists of one large and two smaller specimens about half the size of the larger specimen. Although having fewer spines, they are presumed to be sub-adults of this species. The ocular tubercles of the smaller specimens terminate in an apical cone which was not present in the larger form. The larger specimen is of the same size as the holotype and agrees in almost all respects with Child's description. Differences are principally confined to spination of oviger segments 4–6 which carry numerous long, sharp, simple spines not present on the holotype. Another minor difference is found in the proportions of the femur and tibia 2. Internal ganglia and smooth cuticle in the area where two eyes are usually positioned, suggests that the apparent absence of eyes in the holotype may be a legacy of preservation. Well-defined lateral sensory organs were present on the dorsolateral surface of the ocular tubercle. Palp and oviger gland openings are not evident. Child (1994, fig. 4A) clearly figures a 10-segmented palp; however his description overlooks the small 1st segment. His reference to the 2nd palp segment being longest should in fact be the 3rd segment; the 4th segment should be the 5th and so on. Spines on all longer segments are straight and often longer than the corresponding segment. Child describes the three distal segments as being progressively shorter but in this specimen the 10th segment is 1.2 times longer than the 9th, otherwise all segments agree with the holotype in their proportions. Coxal pellicula and genital pores are not evident in this material.

Numerous gastropod egg capsules were attached to the dorsal surface of the trunk of the larger specimen and ventral surface of one or more legs of all specimens. Most of these capsules were vacated. This species has also much in common with *C. ensifer* Child, 1995 but that species is distinguished by the presence of strong, hooked spines on the palps and on the longer leg segments.

Colossendeis melancholicus Stock, 1975

Figures 5A–H, 7B

Colossendeis melancholicus Stock, 1975: 988–990, figs 11c–f, 12.—Child, 1994:14 [synonymy]

Material examined. Tasmania. NW flank of St Helens Hill, 41°14.7'S, 148°46.1'E, 1755 m, Benthic dredge. RV *Southern Surveyor*, CSIRO, 27 Jul 1999, (cruise SS03/99, stn 62), NMV J48898 (1 female).

Diagnosis. A large, glabrous species with a leg span to about 450 mm. Proboscis tubular, extremely long and down-curved, diameter almost uniform throughout the length; 13–14 times as long as wide and close to 3 times length of the trunk. Anterior

margin of cephalon with 2 small apophyses. Ovipiger claw short, strongly curved. Palp segments 3 and 5 of about equal length. two large, unpigmented teardrop-shaped eyes, lateral sensory organs present. Abdomen arched, reaching beyond coxa 1 of leg 4. Tarsal spines irregular in size, several smaller spines interspaced by a single larger spine. Palp segment 10, 6.3–7.4 times as long as median width.

Distribution. Florida Straits, Caribbean region and the Tasman Sea, off Tasmania. 732 m to 1755 m depth.

Type locality. Grand Bahama: (27°57'N, 78°56'W–27°55'N 78°59'W).

Remarks. The extraordinarily long, down-curved proboscis of this species sets it apart from any other species of *Colossendeis*. Child's (1994:14) observation of inconsistencies between Stock's (1975) figures and his measurements are more general than he noted. Stock's measurements indicate the proboscis length of the holotype is a little more than twice the trunk length and almost 20 times the maximum width. However, based on his fig. 11d,c, the length of the proboscis is closer to 14 times its maximum width and 3 times the trunk length; the same proportions as found in the Tasman Sea specimen. The main claw of all legs is blunt and the terminal claw of the ovipiger is much reduced and more strongly curved than figured by Stock (figs 11f, 12e). Ovipiger segment 6 is longest, gently curved, and a little longer than segment 4. In agreement with the holotype, tiny genital pores are present on the ventral surface of the 2nd coxae of all legs. Propodal sole spines are worn to flat stubs. Faint suture lines separate the trunk segments. The coxal pelliculae are pale and have the appearance of a collapsed blister (fig. 7B). This record represents a significant extension in geographic and bathymetric range for this rarely recorded species.

Colossendeis cf mycterismos Bamber, 2004.

Figure 6A–G

Colossendeis mycterismos Bamber, 2004:7–9. Fig. 3 (A–E)

Material examined. NORFANZ Stations. Holotype: Lord Howe Plateau, 34°12.20'S, 162°41.44'E, 751 m, 26 May 2003, (Tan 0308, stn 084), NMV J48824 (1 specimen).

Paratype: West Norfolk Ridge, Wanganella Bank, (34°37.20'S, 168°57.03'E), 521 m, 3 Jun 2003, (Tan 0308, stn 154), NMV J53080 (1 specimen).

Diagnosis. A fine, delicate species. Leg span to about 55 mm. Proboscis almost 1.5 times length of trunk, greatest diameter in proximal 3rd, down-curved throughout length, strongly tapered distally. Ocular tubercle with apical point, 2 or 4 eyes, pigmented or unpigmented. Legs slender, terminal claw of all legs short, less than one-third propodus; tarsus, shorter than propodus, propodus ratio variable.

Distribution. East coast of Taiwan; Lord Howe Plateau, Tasman Sea.

Remarks. This material enables additional observations to compliment the original description. The proboscis is gently down-curved through its length but more so in distal one-third and articulates from about horizontal, downwards, to what

appears to be a more natural position of about 45°. Palp segment 5 is longest, about 1.2 times longer than segment 3, segment 6, 1.1–1.2 times longer than segment 7 and segments 8, 9 and 10 progressively increase in length. The distal four palp segments were covered in numerous spinules of uniform size; segment 10 is about 4 times as long as wide. The terminal ovipiger claw is straight, smooth and a little longer than half the length of segment 10, finely crenulate spines on segments 7 to 10 are in single row, and number 7:6:6:9. The length of the tarsus relative to the length of the propodus decreased from the 1st pair of legs to the 4th pair in 1 specimen, but in no particular order in the other; the length of the tarsus ranged from 48–97% of the propodus length, the main claw ranged from 27–46% of propodus length. The longer leg segments are gently curved, tibia 1 is equal to, or marginally longer than the femur and tibia 2 is 24–35% longer than tibia 1. The tarsus and propodus have a row of short spines along ventral margin; all segments are covered in short spines, the larger spines interspaced among more numerous shorter spines. Coxal pelliculae were not evident. The ocular tubercle is slightly taller than its basal width, with a variably developed apical point. The four darkly pigmented eyes are of equal size and have convex lenses. Lateral sensory organs were not evident. The genital pores are tiny and placed on the distoventral surface of coxa 2 of all legs. The abdomen is fusiform, curved with a convex dorsal surface and distinctly clavate distally. Differences between the holotype and the Tasman Sea specimens can be summarized as follows. The holotype is about one-third larger than the Tasman Sea specimens and has only one pair of unpigmented eyes; palp segments 3 and 5 are of equal length and segments 6 to 10 are subequal. The femur of the 3rd leg of the holotype is almost 30% shorter than tibia 1, and tibia 2 is only 10% longer than tibia 1. The proboscides of the Tasman Sea specimens are uniformly inflated proximally with a tapered, curved distal region; Bamber's figures (3A, B) show a distinct bulge at one-third the proboscis length and minimal distal curvature. The holotype abdomen was not described, but based on the same figures, it is of uniform width and somewhat convex dorsally. The ovipiger claw is nearly half the length of the 10th segment and has a 'flattened expansion' along its ventral margin (fig. 3C). The number of ovipiger spines in the holotype was not documented for comparison. Ovipiger and palp glands are not evident.

The status of these specimens will have to be reassessed on examination of additional material, particularly as both the holotype and these specimens are recorded from similar depths and are adult, decreasing the chances of differences being attributed to heterogonic growth. Characters of particular significance are the unique variability in the number of eyes from 2 to 4; the differences in the proportions of longer leg segments and differences in the supposed characteristic shape and orientation of the proboscis for which the species was named. Should the proboscis orientation and shape of the *C. mycterismos* holotype prove to be an artefact of preservation, then apart from differences noted above, differences are relatively minor. Rather than introduce another species into a genus already bedevilled by species complexes, I have provisionally referred the specimens to *C. mycterismos*. The specimen from stn 154 was enveloped in a clear, diatom-embedded slime.

Additional measurements and illustrations are provided for future comparison.

Measurements (in mm). Length trunk (frontal margin cephalic segment to tip 4th lateral process) 2.64; width across 2nd lateral processes 0.88; length proboscis (lateral) 3.25; greatest width proboscis 0.50; length abdomen 0.43. Third leg: coxa 1, 0.38; coxa 2, 0.48; coxa 3, 0.38; femur 7.43; tibia 1, 7.43; tibia 2, 9.80; tarsus 0.80; propodus 0.98; claw 0.28.

Oviger; seg. 1, 0.10; seg. 2, 0.25; seg. 3, 0.27; seg. 4, 2.27; seg. 5, 0.62; seg. 6, 3.60; seg. 7, 0.44; seg. 8, 0.35; seg. 9, 0.25; seg. 10, 0.25; claw, 0.16. Palp segments (in mm). seg. 1, 0.02; seg. 2, 0.09; seg. 3, 1.78; seg. 4, 0.18; seg. 5, 2.10; seg. 6, 0.50; seg. 7, 0.44; seg. 8, 0.31; seg. 9, 0.34; seg. 10, 0.40.

Two other species share a similar proboscis shape with *C. mycterismos*; *Colossendeis pipetta* Stock, 1991 and *C. sinuosa* Stock, 1997. As noted by Bamber, the tarsus in both species is longer than the propodus and the proboscides are more tubular distally in both species. *Colossendeis pipetta* can further be distinguished by the higher numbers of spines on oviger segments 7 to 10. Stock described the lateral processes of this species as being separated by twice their own diameter; however his fig. 28B shows them to be separated by about their own diameter. Also, his reference to oviger segments 3 and 5 should be to segments 4 and 6. Stock's brief description of *C. sinuosa* does not enable adequate comparison with that species and his relative descriptions of the palps as being "less elongate" and of "different slenderness", necessitates re-examination of the type material. In the meantime, *C. pipetta* can be primarily characterised by the 'sinuous' shape of the distal portion of the proboscis.

Hedgpethia Turpaeva, 1973

Colossendeis.— Loman, 1908: 22–23

Rhopalorhynchus.— Stock, 1958:116 (part).

Hedgpethia Turpaeva, 1973: 184–185

Type species. *Colossendeis articulata* Loman, 1908

Diagnosis. Trunk clearly segmented, posterior margin of first three segments swollen or flared. Abdomen short, directed somewhat ventrally, sometimes not visible in dorsal aspect. Ocular tubercle prominent, sometimes acutely conical, eyes rarely absent, often large with convex lenses. Proboscis with inflated mid-region, tapering distally, inflated for most of its length, extent of distal taper variable. 4 pairs of legs. Large propodal heel spines absent. Genital pores are on legs 3 and 4, the female genital pores being much larger than those of male.

Hedgpethia dampieri (Child, 1975).

Figure 4A–D

Rhopalorhynchus dampieri.— Child, 1975: 8–10, fig. a–h

Hedgpethia dampieri Turpaeva, 1973: 185

Material examined. South Australia. Great Australian Bight, 31°50.0'S, 130°45.0'E, 55 m, *RV Southern Surveyor* CSIRO, 13 May 2000, (SS01/00 stn 378), NMV J48903 (1 specimen). Holotype: Western Australia. W of Lancelin I., beam trawl, with bryozoans, 113–122 m, 5 Feb 1964, CSIRO stn 46, WAM 70–3953 (1 male).

Paratypes: Western Australia. W of Mandurah, 110 m, 23 Nov 1970, R.V. *Diamantina*, stn. 4. USNM 149237, WAM 71–1789 (1 female). SW of Jurien Bay, 110 m, 9 Dec 1970, R.V. *Diamantina*, stn 108, WAM 71–1791 (1 female).

Diagnosis. A slender species with leg span to about 40 mm. Lateral processes 1, 2 and 3 separated by about twice basal diameter. Ocular tubercle short, eyes bulging. Proboscis slightly down-curved with short basal part, followed by a similarly short inflated part that narrows to a longer, tapered distal part, rounded at the tip. Abdomen almost hidden in dorsal view. Small genital pores present ventrally on 2nd coxa of legs 2–4.

Distribution. S and SW Australia. 110–122 m depth.

Type locality. W of Lancelin I. Western Australia.

Remarks. This specimen is in good agreement with Child's (1975) description. Re-examination of the type material enables a few additional comments. Small genital pores are present on coxa 2 of the female paratypes but are not evident on the smaller holotype which Child determined to be a male. The ventrally placed abdomen is articulated at its base. Segment 10 of the dissected holotype oviger appears to be lost and segments 5–10 of the remaining oviger are missing. The terminal oviger claw of the South Australian specimen is smooth, with a fine, broad knife edge (fig. 4C) and lacks the two tiny teeth of the holotype.

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Pycnogonids (Arthropoda: Pycnogonida) from the Great Australian Bight, southern Australia, with description of two new species.

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Abstract

Staples, D. A. 2007. Pycnogonids (Arthropoda: Pycnogonida) from the Great Australian Bight, southern Australia, with description of two new species. *Memoirs of Museum Victoria* 64: 95–101.

Twelve species of shallow-water pycnogonid belonging to nine genera are represented in this report. Specimens were collected from the Great Australian Bight, southern Australia, at depths of 1–180 m. Two new species in the family Callipallenidae are described: *Pseudopallene chevron* sp. nov. and *Parapallene gowlettiae* sp. nov.

Keywords

Pycnogonids, Southern Australia, Eyre Peninsula, Great Australian Bight, Nymphonidae, Ammotheidae, Callipallenidae, Phoxichilidiidae, Pycnogonidae, Austrodecidae.

Introduction

This collection is mainly comprised of specimens from the west coast of the Eyre Peninsula, South Australia but also includes two species from West Australian waters. The most recent reports on pycnogonids collected from the region are those of Bamber (2005) who reported on the pycnogonids from the Recherche Archipelago, Esperance, Western Australia and Staples (2005; 2007) who reported on pycnogonids collected from two island groups in South Australian waters. The scarcity of reports on the pycnogonid fauna in the intervening region is largely a reflection of the exposed and inaccessible nature of that coastline. It is nevertheless expected that the coastal fauna is typical of a high energy regime and relatively sparse. Previous ship-based surveys have collected few specimens and the logistics of mounting future deep-sea surveys in the region represent a significant barrier to more intensive collecting.

Specimens are lodged in the South Australian Museum, Adelaide (SAM) and Museum Victoria (NMV).

Nymphonidae Wilson, 1878

Nymphon aequidigitatum Haswell, 1884.

Nymphon aequidigitatum Haswell, 1884: 1022–1024, pl. 54, figs 1–5—Clark, 1963: 5–7, fig. 3—Stock, 1973a: 107–108—Staples, 1997: 1050, fig. 21.1a, 21.2c, plate 68.8.

Material examined. South Australia, W side of Wittelbee Point, E of Ceduna, 1–3 m, 7 Mar 1993; coll. W. Zeidler, K.L. Gowlett-Holmes and B. McHenry SAM E3675 (1 male).

Type locality. Port Jackson, New South Wales.

Distribution. Recorded from Gulf St. Vincent, South Australia to Cape Byron, New South Wales, from the intertidal to 20 m depth.

Remarks. The chelae of *N. aequidigitatum* are sexually dimorphic; the male palm more swollen than that of the female. The species is most often found on hydroids, algae, bryozoans and sponge surfaces. Colour is typically straw to pale orange but specimens predominantly assume the colour of their gut content. A narrow, pale mid-dorsal stripe is often present.

Ammotheidae Dohrn, 1891

Achelia shepherdii Stock, 1973b

Achelia shepherdii, Stock, 1973b: 92–95, figs 1–2—Staples, 1997: 1056; fig. 21.7e—Child, 1975: 22–24, fig. 10.

Material examined. S of Eucla, South Australia, Great Australian Bight, (31°50'E, 129°0'S), stn GAB 007, semi-epibenthic sled, 42 m, P. E. Bock and S. J. Hageman, 15 Jul 1995 SAM E3676 (1 male).

Type locality. Bruny I., Tasmania.

Distribution. Western Australia, South Australia, Victoria, Tasmania and east coast of Australia at depths to 50 m.

Remarks. This species is readily distinguished from its Australian congeners by the serrated appearance of the distal palp and possession of a bulbous proboscis.

Ammothea australiensis Flynn, 1919

Ammothea australiensis Flynn, 1919: 95–99—Child, 1975: 24 (earlier refs.)—Staples, 1997: 1067; fig. 21.8b.

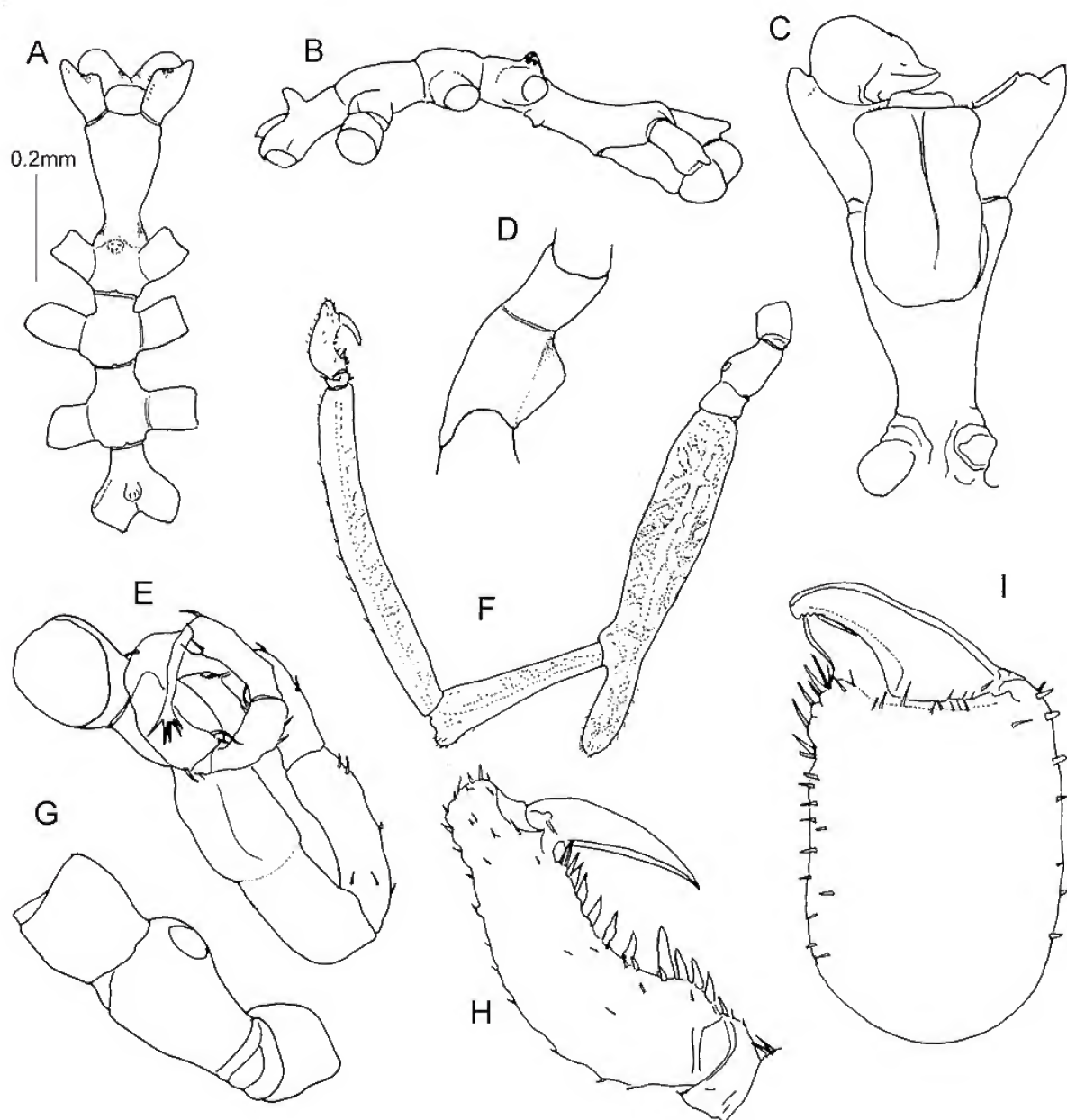


Figure 1 *Parapallene gowlettiae* sp. nov. female holotype (SAM E3678): A, trunk, dorsal; B, trunk, lateral; C, cephalon, ventral; D, oviger segments 3 and 4; E, oviger; F, leg 1; G, coxae; H, propodus, leg 3; I, chela.

Material examined. Point Sinclair jetty, amongst *Galeolaria* tubes, D. Howlett, Jan 1980. SAM E3677 (1 subadult).

Type locality. Port Jackson, New South Wales.

Distribution. Garden I., WA to Port Jackson, NSW and Tasmania. Intertidally to 10 m depth.

Remarks. This small, subadult specimen possesses dorsal trunk tubercles characteristic of *A. australiensis*. This is the most common species along the southern Australian coastline, typically collected from beneath stable rocks and in association with the sedentary polychaete *Galeolaria caespitosa* on which it feeds.

Callipallenidae Hilton, 1942

Parapallene Carpenter, 1892

Parapallene gowlettiae sp. nov.

Figure 1A–I

Material examined. Holotype: Elliston, in algae, S. A. Shepherd, 26 Feb 1978. SAM E3678 (1 female).

Diagnosis. Trunk slightly arched, smooth, fully segmented. Chelifore scape with prominent dorsodistal process. Ovigera 10-segmented, segments 5–7 lying parallel to segments 1–4, terminal claw divided into 5 finger-like processes. Femur with long distal process about one-third length of the segment, tarsus short, propodus strongly curved.

Description. Female holotype. Leg span about 35 mm. Trunk smooth, segmented, lateral processes 2 and 3 separated by about 1.3 times own basal diameters, lateral processes 1–3 separated from trunk by thin cuticular line, segment 4 divided dorsally by longitudinal cuticular line, posterior to the abdomen and extending ventrally, to the anterior margin of trunk segment 4; cephalon neck angled downwards from ocular tubercle, expanding distally. Ocular tubercle conical, positioned over anterior margin of 1st lateral processes, 2 sensory organs prominent; 4 eyes lightly pigmented in preserved specimen. Abdomen curved, fusiform, positioned on dorsal surface of segment 4, short, erect, not visible from ventral aspect, strongly cleft, small papillae either side of anal slit. Proboscis short, attached to ventrodorsal surface of cephalon, basal region barrel-shaped with tiny spines on ventral surface, strongly constricted prior to inflated oral region, oral surface bearing numerous tiny spines, lips protruding. Chelifore scape with prominent dorsodistal process bearing scattered spinules, inner surface with few spines; chela palm almost oblong, inflated, with numerous small, scattered spinules; fingers short, off-set from distal margin of palm, moveable finger longest, with tiny, but well-defined crenulations distally. Ovigera 10-segmented, attached to ventrolateral surfaces of neck, immediately below the anterior margin of the 1st lateral processes; segments 5–7 folded back, lying parallel with segments 1–4, strigilis resting beneath basal segments; segment 1 longer than segment 2, segment 3 significantly swollen, more so on the outside surface, separated from segment 4 by faint suture line, segments 5 and

6 each with a small dorsodistal swelling, segments 7–10 with 2 long, strongly curved ventral spines and 4 smaller dorsal spines; terminal claw about 1.3 times as long as segment 9, without crenulations or serrations, distally, the claw divides into 5 pointed finger-like processes, one of which is bifurcate. The 2nd leg is the only intact, complete leg and is used for measurements: coxa 2, 1.2 times length of coxa 1; femur having a long, distal process almost equal to one-third the length of entire segment and more or less continuous with the median line of the femur, numerous small setae distally; tibia 1 slightly curved, with similar but shorter dorsodistal process, shorter than femur or tibia 2; tibia 2 more slender than tibia 1; tarsus short; propodus curved, extended distally, overreaching base of claw; heel variably defined but not prominent, bearing 3–4 strong spines, distal spine longest; sole armed with about 5 strong spines in mid-region accompanied by smaller lateral spines, all spines finely crenulated. Genital pores large, placed on swollen ventrodorsal surface of coxa 2 in all legs.

Measurements of holotype (mm): trunk length (frontal margin of cephalon to tip of 4th lateral process), 7.40; width (across second lateral processes), 2.85; proboscis length (ventral), 1.64; 2nd leg: coxa 1, 0.88; coxa 2, 1.38; coxa 3, 0.73; femur, 3.7; tibia 1, 2.13; tibia 2, 5.20; tarsus, 0.13; propodus, 1.90; claw, 0.70.

Etymology. Named for Karen Gowlett-Holmes in recognition of her collecting and astute observations of the southern Australian pycnogonid fauna.

Remarks. The exoskeleton of this specimen is partially transparent, revealing a fibrous and diverticulate network of underlying tissue or cuticle. If this feature is evident in live material, it will prove to be a useful diagnostic character. The swollen oviger segment 3 is reminiscent of the similarly swollen segment 6 in several species of *Endeis* (Staples, 1982: 461).

Three species share a distal process on the femur and tibia 1: *Parapallene avida* Stock, 1973; *P. famelica* Flynn, 1929 and *P. haddoni* Carpenter, 1892. In all 3 species the distal femoral processes are much shorter than in *P. gowlettiae* and none share the pointed, finger-like processes on the oviger claw. *Parapallene avida* can further be distinguished by the shape of the chelifores and spination of the leg segments; the lateral processes of *P. famelica* (non Clark, 1963) are separated by about 4 times their own width and *Parapallene haddoni* has a much longer abdomen.

Parapallene australiensis (Hoek, 1881)

Pallene australiensis Hoek, 1881: 76–78, pl. 11: figs 1–7.

Parapallene australiensis Stock, 1991: 190 (earlier refs) — Staples, 1997: 1057, fig. 21.4e pl. 67.2, 68.3.

Material examined. Great Australian Bight, approx 96 nm SW of Elliston, (34° 54.13'S, 133°42.68'E), 180 m epibenthic sled, RV *Franklin*, stn PL 94/08–09, 27 Jun 1994, K. L. Gowlett-Holmes, S. Hagman, Y. Bone, SAM E3679 (1 male).

Type locality. East Monocoeur I., Bass Strait, Tasmania.

Distribution. Cape Naturaliste WA, along the east coast, north to Cape York and New Caledonia at depths 10–240 m.

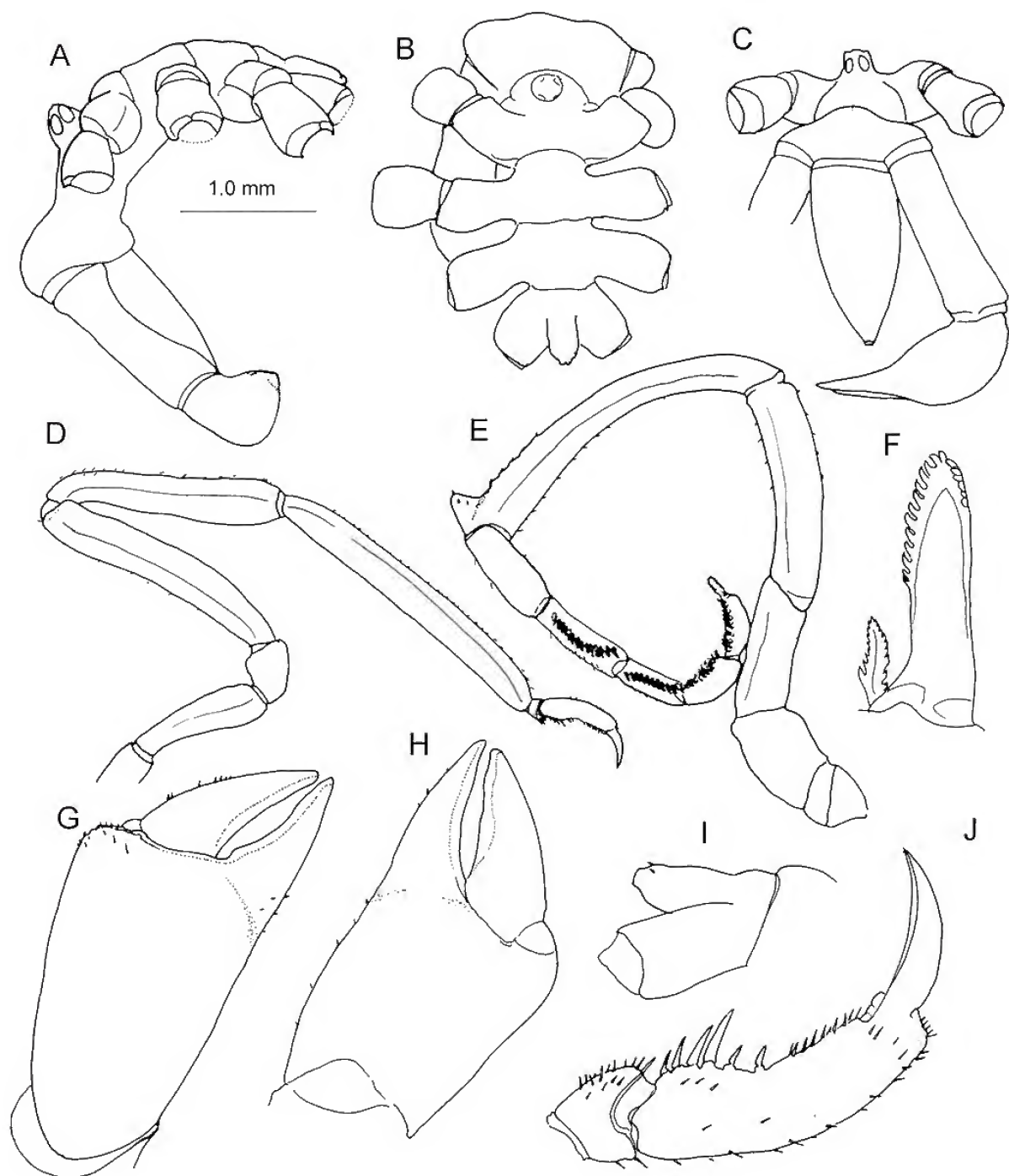


Figure 2 *Pseudopallene chevron* sp. nov. male holotype (SAM E3681): A, trunk, lateral; B, trunk, dorsal; C, trunk, anterior; D, leg 2; E, oviger; F, oviger claw; G, chela exterior; H, chela interior; I, abdomen lateral; J, tarsus and propodus leg 4.

Remarks. The proboscis of this specimen is missing. Colour and markings of live specimens are variable. In southern Australia, this seasonally abundant species is typically uniformly scarlet in colour, matching the hydroid *Halopteris glutinosa*, on which it feeds (Staples, 1997).

***Pseudopallene* Wilson, 1878**

***Pseudopallene reflexa* (Stock, 1968)**

Spasmopallene reflexa Stock, 1968: 40–42, fig. 15a–h.

Pseudopallene reflexa Staples, 2005: 164–166, fig. 4A–I, fig. 5 F, G.

Material examined. Southern Eyre Peninsula, Point Drummond, exposed, 5 m, site 14, code 56, 3 Dec 1995 SAM E3680 (1 male with eggs, 2 females).

Type locality. *Galathea* stn. 571, Great Australian Bight.

Distribution. Investigator Group, Port Phillip Bay, Victoria and southeast coast of Australia at depths 3–72 m.

Remarks. This species is most readily distinguished from its congeners by the paired arrangement of the propodal heel spines.

***Pseudopallene* Wilson, 1878**

***Pseudopallene watsonae* Staples, 2005**

Staples 2005: 160–164, fig. 2A–I.

Western Australia, King George Sound, N of False Bay, on red algae, bryozoa from rock face, 27 m, SCUBA, G. C. B. Poore and H. M. Lew Ton, 15 Apr 1984 (Stn SWA 57) NMV J45348 (1 female).

Type locality. Althorpe I., South Australia.

Distribution. King George Sound, Western Australia; Althorpe I., South Australia; Port Phillip Bay, Victoria.

Remarks. The shape of the chelifore fingers is the most recognizable character separating this species from its congeners. Specimens are uniformly yellow in life. This is a much smaller and finer species than the similarly coloured *P. ambigua*.

***Pseudopallene* Wilson, 1878**

***Pseudopallene chevron* sp. nov.**

Figure 2A–J

Material examined. 1 male, holotype, Waldergrave I., 25 m, 25 Oct 1973 SAM E3681.

Diagnosis. Trunk smooth, completely segmented. Post-ocular surface of cephalon evenly rounded, not divided longitudinally, mid-dorsal mound not present. Abdomen more or less tubular. Proboscis bullet-shaped, without constrictions, margins evenly curved and tapered towards tip. Oviger terminal claw scooped, margin lined with rounded teeth. Red chevron markings on trunk may be a useful diagnostic character.

Description. Leg span about 27.0 mm. Trunk smooth, completely segmented; neck region of cephalon sloping away from base of ocular tubercle; post-ocular surface evenly

rounded, not divided longitudinally, mid-dorsal mound not present; length of lateral processes about 1.5 times maximum width, 1st and 2nd pair separated by about one-quarter of basal widths. Ocular tubercle with 2 prominent dorsal papillae, lateral sensory organs not evident; 4 eyes, darkly pigmented. Abdomen more or less tubular, constricted distally, cleft anal opening. Proboscis bullet-shaped, without constrictions, margins evenly curved and tapered towards tip, 3 lips prominent, extended, oral fringe not evident. Chelifore scape without basal constriction, chela fingers with linear cutting edge, length of moveable finger slightly less than length of palm, dorsal surface of immovable finger with several strong setae on outer surface. Oviger 10-segmented, segment 5 longest, strongly curved, distal apophysis prominent, all segments covered in small, but strong, simple spines; compound spine formula segments 7 to 10, 14:11:10:10, terminal claw scooped, margin lined with 22–26 rounded teeth. 3rd leg: coxa 2, 2.5 times length of coxa 3, tibia 2 longest, femur longer than tibia 1, propodus with 4 strong heel spines, distal-most spine longest, greater than half width of heel, heel spines followed by 2 lesser spines followed by 10–15 much smaller sole spines. Genital pores round, tiny, on ventrodistal surface of legs 3 and 4.

Measurements of holotype (mm): trunk length (frontal margin of cephalic segment to tip of 4th lateral process), 3.5; width (across 2nd lateral processes), 1.55; proboscis length (dorsal), 1.20; 3rd leg: coxa 1, 0.55; coxa 2, 1.38; coxa 3, 0.55; femur, 3.05; tibia 1, 2.64; tibia 2, 3.75; tarsus, 0.25; propodus, 0.85; claw, 0.48.

Remarks. This small species is of a similar size to *P. reflexa* Staples, 2005 with which it shares the absence of a preocular mound and the longitudinal division of the cephalon. It otherwise differs in the arrangement of the propodal heel spines, the shape of the proboscis and abdomen and not having an irregular surface of the legs. The evenly rounded preocular region of the cephalon also resembles that of the much larger and more robust *P. ambigua* but from which it also differs conspicuously in the shapes of the proboscis, the chelifores, the oviger claw and the propodus. It is of interest to note that Bamber (2005: 332) records markings on the trunk and legs of *P. ambigua* from the Recherche Archipelago; a feature uncharacteristic of specimens from southeastern Australia where they are uniformly yellow. Photographs of live *P. chevron* show colour to be predominantly yellow with red markings. Although this preserved specimen has lost all trace of colour, dark V-shaped markings persist on the trunk and a median line extends dorsally along the lateral processes and femur. Bandings on the tibiae, the chelae and part of the cephalon indicate that these areas also were pigmented, perhaps providing useful diagnostic character in live material. This is a common species of *Pseudopallene* in South Australian waters (pers. com. Karen Gowlett-Holmes).

Distribution. Based on photographic records of live specimens, this species may be widely spread in SE Australia.

Etymology. Named for the V-shaped dorsal trunk markings (chevrons) which, in combination with the leg markings, appear to be a distinctive diagnostic character; a noun in apposition.

Pycnothea* Loman, 1921**Pycnothea flynni* Williams, 1940**

Williams, 1940: 202–204, figs 6–9—Clark, 1963: 46–48, fig. 23—Arnaud, 1972:160–161, fig. 2—Stock 1973a:121—Child, 1975: 16, fig. 6—Hooper, 1980: 475—Child, 1992: 30—Staples 1997: 1058, fig. 21.5b.

Material examined. Wittelbee Point, near Ceduna; 9 Aug 1974; coll. W. Zeidler. SAM E3682 (1 specimen).

Type locality. Rottnest I., Western Australia.

Distribution. Madagascar; Pelsart I., Western Australia; South Australia; Victoria; Tasmania; New South Wales, Indo-Pacific. Intertidal to 50 m depth.

Remarks. Genital pores are not evident, suggesting that this specimen may be sub-adult.

Phoxichilidiidae Sars, 1891***Anoplodactylus* Wilson, 1878*****Anoplodactylus evansi* Clark, 1963**

Anoplodactylus evansi Clark, 1963: 51–53, fig. 26 A–G—Stock, 1973: 121–122 fig. 10b—Staples, 1997: 1063 fig. 21.6 pl. 67.5—Bamber, 2005: 338.

Material examined. Point Brown, coralline, rock, 10 m, H. Kirkman SAM E3683 (1 male).

Type locality. Port Jackson, New South Wales.

Distribution. West I., South Australia to Tweed Heads, Queensland and Tasmania. Intertidal to 16 m depth.

Remarks. A particularly colourful species most often collected from amongst red algae in southern Australia (Poore, 2006).

Austrodecidae* Stock, 1954**Austrodecus* Hodgson, 1907*****Austrodecus (Austrodecus) staplesi* Stock 1990**

Austrodecus staplesi Stock 1990: 269–271, figs 1–8—Bamber 2005: 339–340.

Austrodecus tubiferum Staples 1997: 1068, fig. 21.8d.

Material examined. Western Australia, south of Esperance (34°32'S, 123°40'E), 80 m, epibenthic sled, stn GAB 087, 23 Jul 1995, P. E. Bock NMV J56094 (1 male).

Type locality. Split Solitary I., New South Wales.

Distribution. Esperance Bay, Western Australia and along the southeast coast to Coffs Harbour, New South Wales and Tasmania. Depth 14–30 m.

Remarks. This single male is assigned to this species on the basis of the propodus being longer than tibia 2, the location of the cement gland tube on the mid-ventral surface of the femur, the absence of auxiliary claws and possession of 4-segmented ovigers.

Pycnogonidae* Wilson, 1878**Pycnogonum* Brünnich, 1764*****Pycnogonum (Retroviger) aurilineatum* Flynn, 1919b**

Pycnogonum aurilineatum Flynn, 1919: 92–95, X111, figs 1–2, pl. XIV fig. 3—Stock, 1973a: 125—Staples, 1997: 1068–1070, fig. 21.8e, pl. 68.5—Staples, 2002, 549–552, fig. 4A–H.

Material examined. Four Hummocks I. 10 m. shelf, site 16, code 64 bag, H. Kirkman, 3 Dec 1995. SAM E3684 (1 female).

Type locality. Port Arthur, Tasmania.

Distribution. Investigator Group, Great Australian Bight, South Australia; Victoria; SE Tasmania to Coffs Harbour, New South Wales. Intertidal to 23 m.

Remarks. This species is readily recognized by possession of a pale, mid-dorsal stripe.

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Notes on *Candelabrum australe* (Briggs, 1928) (Hydrozoa, Anthoathecatae)

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Abstract

Watson, J. E. 2007 Notes on *Candelabrum australe* Briggs, 1928 (Hydrozoa, anthoathecatae). *Memoirs of Museum Victoria* 64: 103–106.

Candelabrum australe is a rare species known only from southern Australian waters and is reported for the first time from New Zealand. The large cap-shaped hydranth is very active. The cnidome comprises at least nine size-classes of nematocysts in four morphological categories. The hydranth is bisexual, the sexes borne separately on stout branched blastostyles from which lobate actinula larvae are released.

Keywords

Candelabrum australe, southern Australia, New Zealand, active hydranth, cnidome, bisexual, actinula larva.

Introduction

Two species of *Candelabrum* (*Myriothela australis* Briggs, 1928 and *Myriothela harrisoni* Briggs, 1928) are known from south-eastern Australia. Briggs (1928; 1929; 1930) gave detailed histological descriptions of both species. His pale flesh-pink specimens of *Candelabrum australe* were attached to the thalli of seaweed drifted on the beach at Maroubra Bay, New South Wales but were in poor condition; *Candelabrum harrisoni* occurred in numbers hanging from the underside of rocks in the shallow sublittoral at Bulli, south of Sydney, New South Wales.

Candelabrum australe was first recorded from Port Phillip, Victoria, by Ralph (1966). Since then it has been reported occasionally from the same locality by scuba divers and tide pool collectors. There are two preserved specimens of *C. australe* in the Ralph collection held in the National Museum of New Zealand (NMNZ no. 1216), collected in 1969 from the Banks Peninsula near Christchurch in the South Island.

A fully grown specimen of *C. australe* was observed in southern Port Phillip Bay by the author in June 2007 on the thallus of the brown kelp *Ecklonia radiata* in shallow water 2 m deep. Two months later (August 2007) it was photographed *in situ* and collected for laboratory examination. Mid-winter water temperature at the time of collection was 10°C.

Segonzac and Vervoort (1995) reviewed the then known 18 species of the genus *Candelabrum*. Since then, Shuchert (1996) described but did not name an infertile, juvenile specimen of a putative new species from New Zealand. Hewitt and Goddard (2001) described a new species, *Candelabrum fritschmanii* from the Pacific coast of the USA, bringing to 20 the known species of *Candelabrum*. Briggs (1928) made only passing mention of the nematocysts of *C. australe* and Manton

(1940) and Hewitt and Goddard (2001) provided accounts of the cnidome of several species of *Candelabrum*.

Observations of living material in the present study now supplement Briggs' (1928; 1929) descriptions of *C. australe* and provide detailed information on the cnidome of the species.

Family Candelabridae de Blainville, 1830

Solitary hydroids; hydranth elongated, body cylindrical to tapering, divided into 3 regions: a basal region (hydrorhiza), a mid-region (blastostyle) and an elongate body with a circular distal mouth. Hydrorhiza short, stout with tubular or root-like adhesive processes, with or without perisarc; body with thickened mesolamella and gastrodermal villi and numerous scattered, capitate tentacles, simple or compound; gonophores developing directly on hydranth or on blastostyles in a budding zone below body.

Candelabrum australe (Briggs 1928)

Myriothela australis Briggs, 1928: 307, pl. 32, pl. 33, fig. 3, pl. 34, figs 1–4.—Briggs 1929: 244, figs 1–4, pls 42–44.—Briggs, 1939: 10.—Manton, 1940: 280 *et seq.* fig. 8a.—Dakin, Bennett and Pope, 1948: 208.—Ralph, 1966: 158, 162.

Candelebrum australe —Segonzac and Vervoort, 1995: 35.—Hewitt and Goddard, 2001: 2280.

Description. Living material (supplementing Briggs 1928). Contracted hydroid cap-like in appearance, the gonophore-bearing blastostyle region forming a decorative circular basal rim and the body a tapering crown.

Hydrorhiza comprising numerous short stolons covered by perisarc radiating from below the base of the hydranth but obscured by the living animal; stolons terminating in small

Table 1. Nematocysts of *Candelabrum australe*

Nematocyst	Capsule	Dimensions	Shaft	Tube/thread	Body tentacle	Blastostyle tentacle
Desmoneme (fig. 3A)	Elongate ovoid	18–20 x 12–15	-	Long, strongly coiled ¹	****	Absent
Desmoneme (fig. 3B)	Elongate ovoid	10–12 x 7–9	-	Coiled	***	*
Stenotele (fig. 3C)	Ovoid	21 x 13	Undischarged	-	*	Absent
Stenotele (fig. 3D)	Ovoid	15 x 13	Length 12 μ m	-	****	Absent
Stenotele (fig. 3E)	Round	15 x 11	Thick, length 10 μ m	-	***	*
Stenotele (fig. 3F)	Ovoid	12 x 10	Undischarged	-	**	**
Merotrichous isorhiza (fig. 3G)	Ovoid	19–22 x 14–16	-	Long, spinous ²	**	****
Merotrichous Isorhiza? (fig. 3H)	Paddle-shape	8–9 x 5–6	Undischarged	-	**	*
Mesotele (fig. 3I)	Leaf-shaped	18–21 x 7–9	Length 18 μ m, spinous ³	Moderately long	**	***

Order of abundance of nematocysts: **** (very abundant) to * (rare).
Notes. a. The shafts of the largest desmonemes are long and thick, with spines lining the proximal inner 3rd of the coil. b. Nematocysts identified here as merotrichous isorhizas may belong to 3 distinct size-classes or to 1 class with a capsule very variable in size. Those on the blastostyle tentacles are somewhat larger, extremely abundant and densely packed along the surface of the tentacle; when disturbed, an immensely long thread (tubule) much longer than those of the body tentacles is ejected. The thread is smooth proximally followed by a finely spinous section c. 30 μ m long, then a very long smooth distal thread. c. The shafts of the mesoteles are long and spindle-shaped with a moderately swollen spinous head and long thread.
The living hydroid is dark orange in colour showing paler longitudinal bands when the body is extended; mature female gonophores paler yellow; apices of the blastostyle tentacles and the apical cap of mature gonophores with a dark brown granular band.

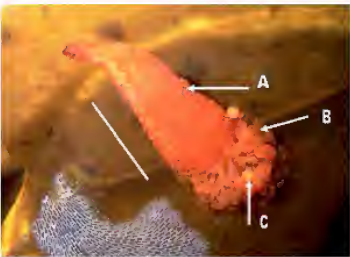


Figure 1. *Candelabrum australe*. Laboratory photograph of partially extended hydranth on *Ecklonia radiata* thallus. A, capitate body tentacles; B, blastostyle tentacles; C, mature gonophore. Scale bar: 2 cm.

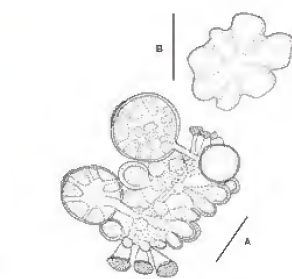


Figure 2 A, female blastostyle with clusters of tentacles and young and mature gonophores containing larvae. B, actinula larva several hours after liberation. Scale bar: A, 2 mm; B, 0.5 mm.

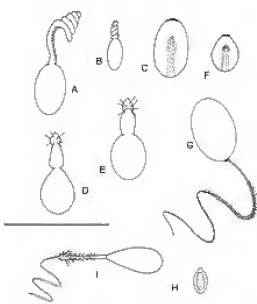


Figure 3 A, large desmoneme from body tentacles. B, small desmoneme. C–F, stenoteles. G, large merotrichous isorhiza. H, small ?merotrichous isorhiza. I, mesotele. Scale bar: 30 μ m.

circular disks firmly attached to the algal thallus; hydrorhiza entirely covered by a thin greyish layer of mucus. Body not extending into the blastostyle region.
Body tentacles capitate, globular, numbering about 1500 (Briggs 1928), crowded together on the contracted hydranth but separated when body expanded; tentacles borne on stout transparent peduncles and richly armed with nematocysts. Blastostyles crowded on lower body, bearing clusters of 6–10

apically flattened tentacles on stout peduncles; tentacles armed with 100s of large nematocysts.
Hydranth bisexual, gonophores fixed sporosacs, male and female gonophores borne separately on stout branched blastostyles among clusters of tentacles; blastostyles comprising numerous developing and mature gonophores; mature gonophores of both sexes spherical, c. 1 mm in diameter with a flattened circular apical cap. Several larvae visible inside

mature female gonophores. Actinula larvae were liberated after 36 hours in the laboratory; larvae flattened, typically lobate but variable in shape, capable of slow, barely perceptible movement.

At least 9 size-classes of nematocysts in 4 morphological categories in the cnidome of the hydranth, all size-classes occurring in the body tentacles and 6 size-classes in the blastostyle tentacles. Data on the nematocysts are summarized in Table 1.

Remarks. The common brown kelp *Ecklonia radiata* grows in depths of 1–20 m in southern Australia and is likely the seaweed upon which Briggs found his New South Wales specimens of *Candelabrum australe*. The New Zealand material provided no information about substrate but *E. radiata* is also a common coastal kelp near Christchurch in the South Island. Although the few southern Australian records of *C. australe* suggest it is a rare species, it is probably widely distributed in the abundant *Ecklonia* habitat.

The smooth, long-lived *Ecklonia* thallus would provide an excellent substrate for attachment of a large hydroid lacking a firm hydrocaulus. The hydrorhiza is strongly adherent to the alga by radiating disk-like stolonal plugs. At the site of attachment to the algal thallus there is a distinct light-coloured aureole indicating reaction of the hydrorhizal mucus sheath with the alga.

The tapering body of the hydranth is remarkably extensile and prehensile, extending rapidly from 2–6 cm, sweeping back and forth over the algal substrate somewhat reminiscent of an elephant's trunk. It is highly sensitive to stimulus, contracting rapidly when touched. Authors' descriptions of species of *Candelabrum* report a small circular mouth but this is probably an artifact of preservation. In contrast, the mouth of living *C. australe* is widely open when actively exploring the substrate.

Briggs (1929) gave a detailed description of the development of the gonophores and formation of the egg of *C. australe* but as his specimens were almost dead, he could not provide information on larval development. Schuchert (1996) observed a juvenile specimen of an undescribed species of *Candelabrum* from New Zealand. The specimen moved about slowly for several weeks in the laboratory before adhering to a suitable surface. In the present laboratory study, following liberation, several flesh-pink larvae of *C. australe* moved sluggishly for several hours on the *Ecklonia* substrate before attaching by a plug of mucus. Rapid adherence of the larva to the algal substrate would be a vital adaptation in strong water movement of the *Ecklonia* habitat.

Several morphological categories of nematocysts comprising the cnidome of *Candelabrum* have been noted by authors: Jaderholm (1905), Manton (1940), Millard (1975), Segonzac and Vervoort (1995), Hewitt and Goddard (2001). Manton (1940) provides a broad classification and illustration of the cnidome of *Candelabrum penola* (Manton, 1940), *Candelabrum capensis* (Manton, 1940) and *Candelabrum cocksii* (Vigurs, 1849) including heteronemes (= mesoteles), stenoteles, desmonemes and haplonemes (= meretricious

isorhizas). Millard (1975) figures the nematocysts comprising the cnidome of *C. capensis* and *C. tentaculata* (Millard, 1966) and Hewitt and Goddard (2001) tabulate the cnidome of known species of the genus. The cnidome of *C. australe* comprises the same morphological categories of nematocysts as reported by these authors.

Examination of the gross morphological features of the New Zealand material confirmed its identity as *C. australe*, thus extending the range of the species from 34–44°S and across the Tasman Sea. As none of the nematocysts were discharged in the New Zealand material and the cnidome had deteriorated in preservation, no detailed examination of the nematocysts was possible.

The arrangement of the body desmoneme tentacles of *C. australe* is such that they would provide little assistance in capturing and passing prey to the mouth; their function is clearly that of defence. Laboratory observations indicated that the large active mouth of the hydranth is capable of engulfing prey, suggesting the species could possibly be regarded as a grazer rather than a static predator.

In contrast to the body tentacles, the cnidome of the blastostyles is overwhelmingly dominated by meretricious isorhizas aggressively armed with extraordinarily long barbed threads capable of entangling large predators of the gonophores.

Manton (1940) postulated that the hydranth of *C. penola* may be long-lived, taking some years to reach maturity. Longevity would be advantageous for a large and active hydranth, allowing time for investment of energy in growth, feeding and reproduction. Such longevity requires a firm, equally long-lived substrate such as *Ecklonia* for settlement and growth. While the life-span of *C. australe* is still unknown, it spans several years, as the same 2 individuals were regularly observed over a period of at least 3 years on an *Ecklonia* plant in a shallow tide pool at Port Phillip Heads (R. Burn, pers. com.).

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New apseudomorph tanaidaceans (Crustacea: Peracarida: Tanaidacea) from eastern Australia: Apseudidae, Whiteleggiidae, Metapseudidae and Pagurapseudidae

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Abstract

Błażewicz-Paszkowycz, M., and Bamber, R. N. 2007 New apseudomorph tanaidaceans (Crustacea: Peracarida: Tanaidacea) from eastern Australia: Apseudidae, Whiteleggiidae, Metapseudidae and Pagurapseudidae. *Memoirs of Museum Victoria* 64: 107–148.

Investigation of apseudomorph tanaidacean material collected between 1979 and 1984 from Bass Strait and held in the collections of Museum Victoria, Melbourne, Australia, has revealed eight new species, five in Apseudidae (including one new genus), two in Metapseudidae (including one new genus) and one in Pagurapseudidae. These taxa are described below. The new apseudid genus *Annexos* shows great similarity to *Apseudes sensu stricto*, but is without an exopod on the cheliped or on pereopod 1. Two new species of *Apseudes* show a common feature of maxilliped spination in eastern Australian taxa; *Spinosapseudes colobus* sp. nov., the second species of this genus, is described from a similar geography to the first, but is distinguished by the proportionately more compact articles of the antennular and antennal peduncles, the mandibular palp and the pereopods. *Pugiodactylus syntomos* sp. nov. is predominantly distinguished by having compact articles in the antenna, cheliped and pereopod 1; *Labraxeudes heliodiscus* gen. et sp. nov. (Metapseudidae) has a unique combination of substantial rostrum, exopodites on the cheliped and pereopod 1, compact antenna, short uropod, simple pereonite setation, compact propodi, dorsum of pereopod 1 basis without apophyses, robust cheliped and antennule peduncle without inner row of conspicuous denticulation; *Metapseudes wilsoni* sp. nov., only the second species of this genus to be discovered, is distinguished by its conspicuously more slender antennules and antennae with more pronounced, pointed denticulations on the proximal antennule peduncle article, and one fewer article in the main flagellum of the antennule; *Similipedia diarris* sp. nov., again the second species of this genus to be discovered, is distinguished by having no squama on the antenna, no rostrum, and dorsal spiniform apophyses rather than setae on the pereonites.

Keywords

Tanaidacea, Apseudomorpha, Australia, Bass Strait, *Annexos*, *Apseudes*, *Gollumudes*, *Spinosapseudes*, *Pseudowhiteleggia*, *Pugiodactylus*, *Labraxeudes*, *Metapseudes*, *Similipedia*, *Whiteleggia*.

Introduction

Recent investigations of the Tanaidacea of Australia have discovered high diversity of this group of the Peracarida, including a relatively large number of previously undescribed species and genera (see Błażewicz-Paszkowycz and Bamber, 2007 for literature). Most recently, Guțu (2006), Błażewicz-Paszkowycz and Bamber (2007) and Bamber (in press) have described a number of new taxa from Eastern Australia, predominantly Moreton Bay, Brisbane, and Bass Strait.

Błażewicz-Paszkowycz and Bamber (2007) described, *inter alia*, parapseudid taxa collected during the period 1979–1984 within Bass Strait (see Wilson and Poore, 1987) over a wide depth range, and held in the collections of Museum Victoria, Melbourne. The present paper continues this work by describing further apseudomorph material from those and other collections held at the Museum, including eight new species, five in

Apseudidae (including one new genus), two in Metapseudidae (including one new genus) and one in Pagurapseudidae.

The type material and other studied materials are deposited at Museum Victoria (Melbourne, Australia).

Morphological terminology is as in Bamber and Shearer (2005) and Błażewicz-Paszkowycz and Bamber (2007), except that the plumose sensory setae commonly occurring on tanaidacean antennae and pereopod bases, *inter alia*, (“broom setae” *sens. auctt.*) are referred to as penicillate setae to be consistent with terminology in other crustacean groups (and because brooms have so many different shapes around the world); comb-rows of fine setules, occasionally present on maxillae and pereopod articles, *inter alia*, (e.g. fig. 24E) are referred to as microtrichia. Serially repetitive body-parts, such as the subdivisions of the antennal flagella and of the uropod rami are segments, while those with independent musculature (such as the

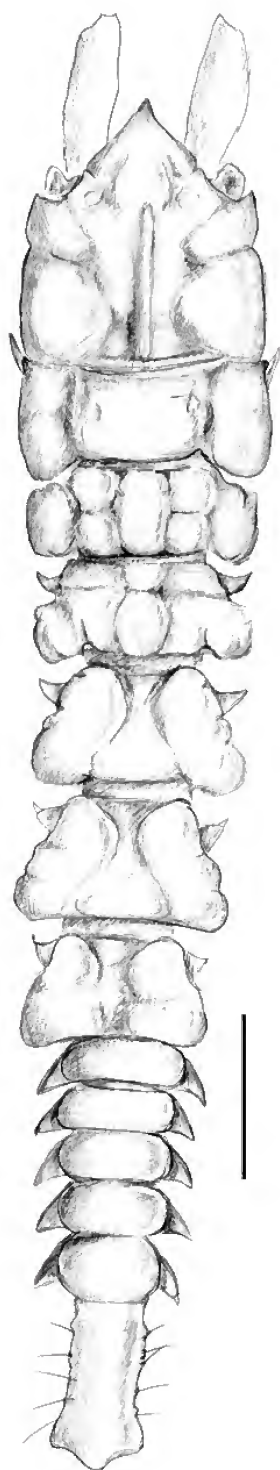


Figure 1. *Annexos abditospina* gen. et sp. nov., holotype female, dorsal. Scale line = 1mm.

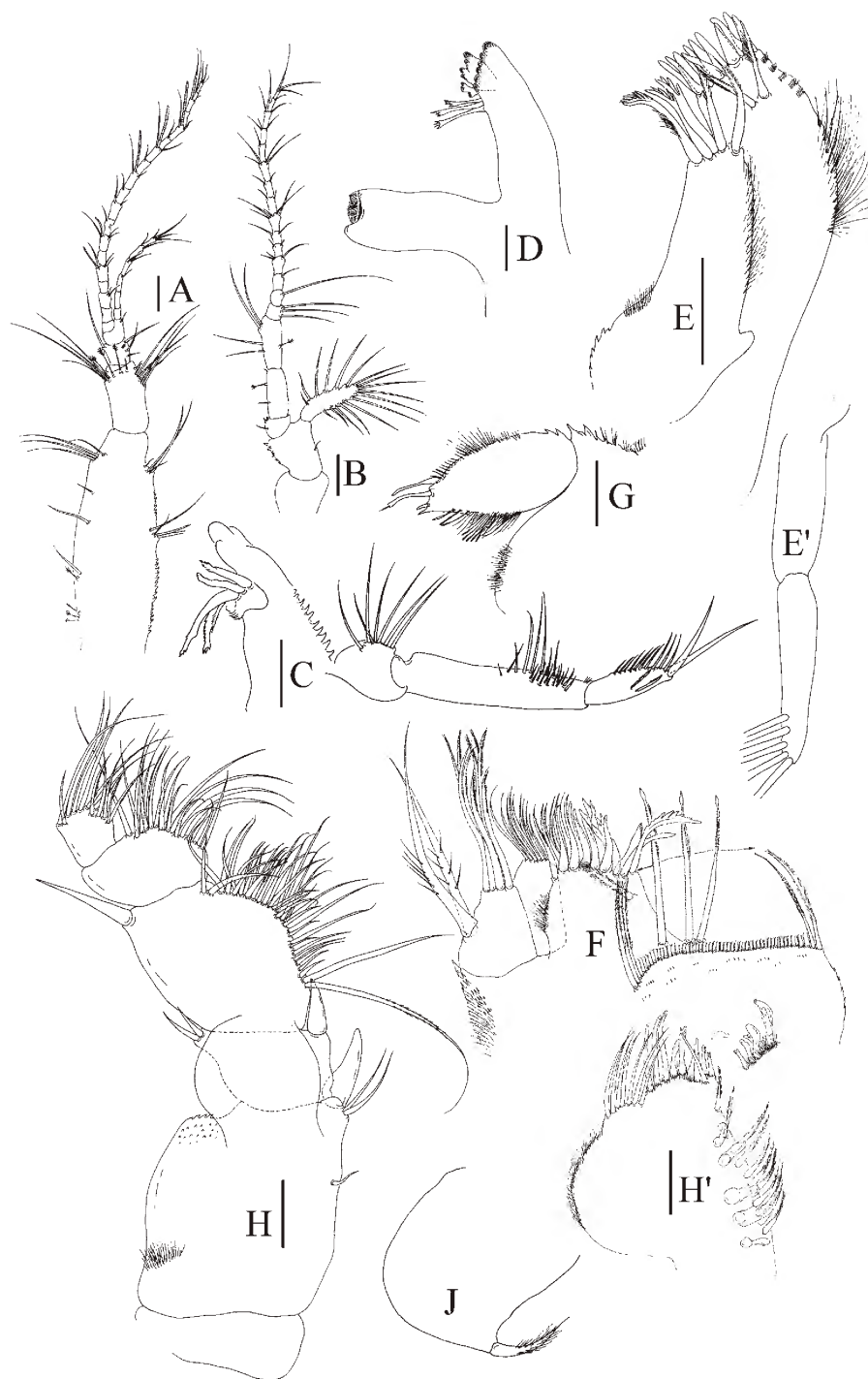


Figure 2. *Annexos abditospina* gen. et sp. nov., A, antennule; B, antenna; C, right mandible; D, left mandible; E, maxillule; F, maxilla; G, labium; H, maxilliped; H', maxilliped endite; J, epignath. Scale line = 0.1 mm.

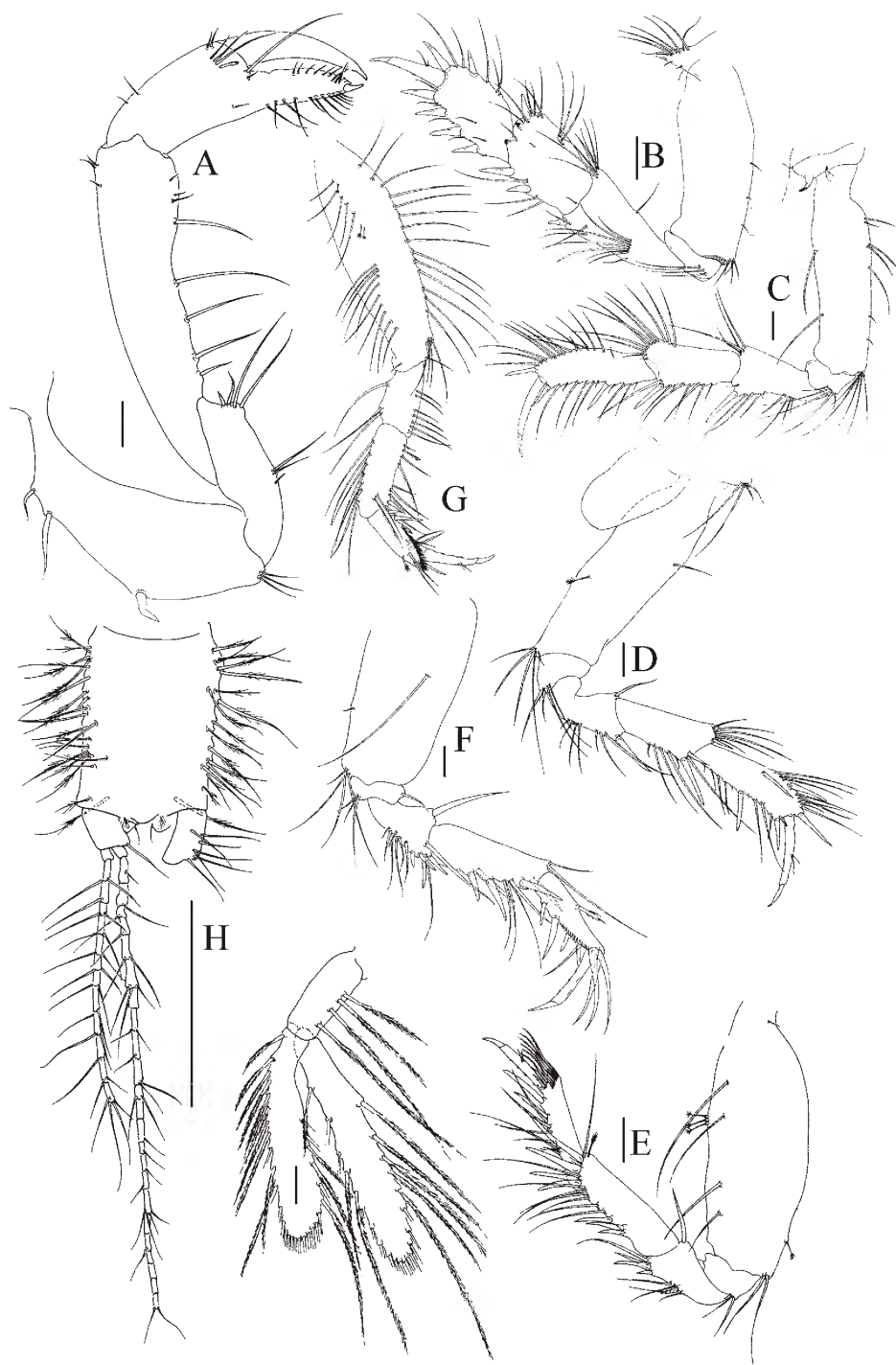


Figure 3. *Annexos abditospina* gen. et sp. nov., A, cheliped; B–G, pereopods 1–6 respectively; H, pleotelson and left uropod; I, pleopod. Scale line = 0.1mm.

parts of the pereopods) are articles. The term “spines” is used in the traditional (and etymologically correct) sense of rigid “thorn-like” structures (avoiding the contextual oxymoron “spiniform setae” *sensu* Watling, 1989) to distinguish them from the flexible “hair-like” setae; non-articulating spiniform extensions of the cuticle are mainly considered to be apophyses.

Measurements are made axially, dorsally on the body and antennae, laterally on pereopods.

Sex determination is confusing in apseudomorphs owing to the phenomenon of hermaphroditism at certain stages of particular species which retain rudimentary oostegites and genital cones at the same time (Drumm and Heard, studies in progress). It is not the purpose of this paper to solve the problem of apseudomorph hermaphroditism; therefore we simplified the question and unless the marsupium was fully developed (in case of the females) or secondary sexual characters were apparent (in case of the males) the sex determination was avoided. Consequently, the individuals with both rudimentary oostegites and with genital cone were called hermaphrodite.

Order **Tanaidacea** Dana, 1849

Suborder **Apseudomorpha** Sieg, 1980

Superfamily **Apseudoidea** Leach, 1814

Family **Apseudidae** Leach, 1814

Subfamily **Apseudinae** Leach, 1814

Remarks. The genus *Apseudes* has long been used as a convenient taxon in which to describe symmetrical, dorsoventrally-flattened apseudomorphs of a “standard” morphology with a spiniform apophysis on the coxa of pereopod-1, largely as it was the first apseudomorph genus to be named, preceding the next (*Parapseudes* Sars, 1882 and *Sphyrapus* Sars, 1882) by 68 years. It has long been recognised that *Apseudes sensu lato* is polyphyletic, and since 1970 a number of the (then) 60-odd species which accord with the above definition has been split off into new genera such as *Fageapseudes* Băcescu and Guțu, 1971, *Tuberapseudes* Băcescu and Guțu, 1971, *Atlantapseudes* Băcescu 1978, *Langapseudes* Băcescu 1987, and *Hoplomachus* Guțu, 2002. Guțu (2006) has recently undertaken a useful reanalysis of the formerly polyphyletic genus, restricting *Apseudes* and resurrecting *Apseudopsis* Norman, 1899, *inter alia*, affording a valuable basis from which, in Guțu’s own words, a more minute revision will be enabled in the future (for example by multivariate analysis).

With the discovery in the present material of 4 species of Apseudinae, their morphology has been compared with 58 specific taxa (as alluded to above) using a dataset based on 21 morphological features (where available), in an attempt to base generic diagnoses on overall morphology rather than biasing classification to that of individual characters (“Characters come from the genus, not the genus from the characters”: Linné, 1751). Having said that, the 1st taxon below shows sufficient distinction in 1 major character to support its separation to a new genus.

Genus ***Annexos*** gen. nov.

Diagnosis. Coxa of pereopod 1 with conspicuous spine-like apophysis. Rostrum triangular; cephalon without spines anterior to the branchial chamber; pereonites 3 to 6 with anterior spine-like apophyses; pleotelson longer than wide. Antennule with internal margin of proximal peduncle article finely corrugated; flagella multisegmented. Cheliped and pereopod 1 without exopodite. Pereopods 1 to 3 with proximal inner hooks on basis. 5 pairs of pleopods; uropods filiform and multi-segmented.

Etymology. Contrived from *an* – without, and *exopod*, the only character which removes this taxon from *Apseudes* being the absence of an exopod on the cheliped and on pereopod 1.

Type species. *Annexos abditospina* sp. nov. by original designation.

Gender. Feminine.

Remarks. This genus has close morphological similarity to the genus *Apseudes*, notably the approximately 16 species of *Apseudes* with anterolateral spiniform apophyses on the pereonites but no lateral spiniform apophysis anterior to the branchial chamber, including the type species *A. talpa* (Montagu, 1808) with its triangular rostrum and internal corrugation on the antennule peduncle. However, *Annexos* gen. nov. is entirely without exopodites on both the cheliped and pereopod 1, a feature differentiating the genus from all other Apseudinae. There are 3 genera within the Apseudinae which lack exopodites on only pereopod 1, viz. *Atlantapseudes* Băcescu, 1978, *Typhlapseudes* Beddard, 1886, and *Mendamanus* Bamber, 1998, but all have an exopodite on the cheliped. The genus *Fageapseudes* Băcescu and Guțu, 1971, lacks exopodites on both cheliped and pereopod 1 but this genus has recently been reclassified into *Leviapseudinae* (Bamber, 2007).

With only 1 species, it is difficult to decide which of the other features of this species might be generic characters. The proximal basal hooks on the pereopods are also found in *Apseudes atuni* Bamber, 2005, from southwestern Australia, although that species has these apophyses on pereopods 4 to 6 as well. The serrations on the body of the mandible, and the robust proximal spines on the maxilliped are distinctive, but *Apseudes bucospinosus* Guțu, 2006, from Heron I., Queensland, also has inner-distal “spiniform processes” on the basis and proximal palp article of the maxilliped (from which it derives its specific name), possibly analogous to the spines of the present species.

Annexos abditospina sp. nov.

Figures 1–3

Material. Brooding female, holotype (NMV J53137) Australia, Victoria, Eastern Bass Strait, 20 km SE of Port Albert (38°43.04'S, 144°18.02'E), 79 m, 18/11/1981, (BSS 178), Wilson, RS et al.

Paratypes: 20 hermaphrodites (NMV J55745), same locality as holotype; 1 specimen dissected on slides (NMV J55945), same locality as holotype; VIMS Cruise 81-T-1, NZOI RV *Tangaroa*, Stn 178, 20 km SE of Port Albert, Victoria, 38°43.4'S 146°56.9'E, 26 m depth, 18 Nov 1981; coll. R. Wilson; 3 individuals (NMV J55776), Tasmania, eastern Bass Strait, 20 km SSW of Babel I. (40°06.48'S, 148°24.18'E),

22 m, 14/11/1981 (BSS 166), R.S. Wilson; 1 individual (NMV J55777), Tasmania, central Bass Strait, 23 km E of Cape Rochon, Three Hummock I. (40°22.12'S, 145°17.00'E), 40 m, 03/11/1980, (BSS 112), M.F. Gomon and G.C.B. Poore; 5 hermaphrodites (NMV J55778), Victoria, eastern Bass Strait, 8 km S of South East Point, Wilsons Promontory (39°12.54'S, 146°27.18'E), 65 m, 18/11/1981, (BSS 180), R.S. Wilson; 1 individual (NMV J55779), eastern Bass Strait, 50 km SE of Port Albert (38°54.18'S, 147°13.24'E), 58 m, 18/11/1981, (BSS 176), R.S. Wilson; 1 ovigerous female, 2 hermaphrodites, 5 individuals (NMV J55780), eastern Bass Strait, 43 km SE of Port Albert (38°53.42'S, 147°06.30'E), 58 m, 18/11/1981, (BSS 177), R.S. Wilson.

Description of female. Body dorsoventrally flattened, elongate, holotype 9.2 mm long (tip of rostrum to posterior of pleotelson), 6 times as long as wide, narrower posteriorly. Cephalothorax subrectangular, slightly longer than wide, anterior margin with conspicuous triangular, pointed rostrum with notches just anterior to ocular lobes. Eyes present; eyelobes rounded; no lateral spiniform apophyses anterior of branchial chambers. 6 free pereonites; pereonites 1 and 2 subequal in length, almost 1/3 as long as cephalothorax, lateral margins uniformly convex, dorsal sculpturing conspicuous; pereonites 3 to 6 with anterolateral spiniform apophyses and expanded posterolaterally at attachment of coxae; pereonite 3 as long as pereonite 2, pereonites 4, 5 and 6 subequal (5 longest), 1.3 times as long as pereonite 1 (all pereonites respectively 2.7, 2.4, 2.1, 1.7, 1.6 and 1.5 times as wide as long); conspicuous sickle-shaped ventral hyposphenium on pereonite 1, blunt hyposphenium with distal, posteriorly-directed spine, on pereonite 6. Pleon 1/3 as long as body, of 5 free subequal pleonites bearing pleopods; pleonites dorsally convex, more than 3 times as wide as long, laterally expanded by spiniform apophyses. Pleotelson rectangular, slender, 2.2 times as long as wide, with numerous plumose lateral setae.

Antennule peduncle 4-articled, proximal article 2.9 times as long as wide, internal margin finely corrugated, outer proximal penicillate setae, outer and inner tufts of simple setae at midlength and distally; article-2 0.3 times as long as article 1, with distal crown of inner and outer simple setae and dorsal penicillate setae; article 3 one-third as long as article 2, article 4 just shorter than article 3. Main flagellum of 19 segments; segments 11, 13 and 15 bearing aesthetascs; accessory flagellum of 6 articles.

Antenna proximal peduncle article without apophyses; article 2 inner margin finely denticulate, bearing elongate squama with 17 plumose marginal setae; peduncle article 3 as long as wide, with 1 seta; article 4 slightly shorter than article 5, and 3 times as long as article 3; article 5 with strong outer setae. Flagellum of 15 segments.

Mouth parts. Labrum not seen. Left mandible, bearing strong, crenulated pars incisive; lacinia mobilis with denticulate cutting edge, setiferous lobe with 4 bifurcate or trifurcate setae; pars molaris robust, blunt. Right mandible as left but without lacinia mobilis; outer margin denticulate; mandibular palp of 3 articles, article 1 just longer than wide with 7 inner setae, article 2 3.5 times as long as article 1 with group of longer and shorter simple inner setae in distal half; article 3 half length of article 2 with 10 inner simple setae increasing in length distally, 2 dorsal subdistal simple setae, and 2 longer distal setae. Maxillule inner endite with finely setose outer margin and blunt apophysis,

inner margin proximally denticulate with adjacent setulose margin; 5 finely setulate distal setae, inner 3 distally compound; outer endite with 11 distal spines and 2 subdistal setae, outer margin finely setose, distally with microtrichia; palp of 2 articles, distally with 5 setae. Maxilla with serrations and setules on outer margin; outer lobe of outer endite with 2 setae with setules at midlength on outer margin, 8 distal setae, each distally setulose; inner lobe of movable endite with dense group of simple distal setae; outer lobe of inner endite with 6 simple, 3 trifurcate, 2 inner compound and 1 subdistal setulose spines; inner lobe of fixed endite with rostral row of numerous setae guarding 3 longer setae. Labium with distally-serrated outer margin and setulose distal margin, palp with fine lateral setules and 2 longer and 1 very-short distal setae. Maxilliped basis with inner and distal setae and inner-distal stout spine; palp article 1 with paired distal spines on outer margin and stout inner-distal spine; palp article 2 longer than wide, with rows of numerous short setae on inner margin, 2 longer proximal setae as long as article, outer margin with spine distally; palp article 3 wider than long, with numerous simple filtering setae along inner margin; palp article 4 with 5 distal setae, 1 outer subdistal seta and 5 inner distal setae. Endite with flagellate inner caudodistal seta, simple outer distal setae and stout, spatulate, distal spines; 5 coupling hooks. Epignath large, cup-shaped, distal spine setulose.

Cheliped slender. Basis 2.4 times as long as wide, dorsally naked, ventrally with 1 longer and 1 shorter proximal seta, midventral spine and tuft of 3 distal setae; exopodite absent. Merus elongate, narrower proximally, with midventral simple setae and ventrodistal group of 3 setae and short spine. Carpus 4.7 times as long as wide, with simple setae along ventral margin, dorsal and ventral distal setae much shorter. Chela fingers shorter than palm, ventral margin of fixed finger with 10 setae, longer seta at inner base of fixed finger; 6 setae near articulation of fixed finger; cutting edge of fixed finger with row of fine setules but no apophyses; dactylus with no apophyses on cutting edge, distal claw pointed.

Pereopod 1 with pronounced, setose spine-like apophysis on coxa. Basis stout, 3 times as long as wide, with sparse ventral setae, 3 distal setae around ventrodistal spine; inner proximal hook-like apophysis; exopodite absent. Ischium with 3 simple ventrodistal setae. Merus half as long as basis, with groups of ventral submarginal and dorsodistal setae, single ventrodistal spine but no dorsodistal spine. Carpus 0.8 times as long as merus, ventrally with 2 spines in distal half, and single dorsodistal spine. Propodus slightly shorter than carpus, with 4 ventral and 2 dorsal spines. Dactylus with mid-dorsal fine setae, no apparent ventral denticulations; unguis short.

Pereopod 2 more slender. Coxa with small spiniform apophysis. Basis 3.6 times as long as wide with 2 longer marginal, numerous ventral marginal and tuft of ventrodistal setae. Merus 0.8 times as long as carpus, with elongate ventral setae and slender ventrodistal spine. Carpus elongate, with rows of ventral and dorsodistal setae, and ventrodistal spine. Propodus 1.2 times as long as carpus, dorsal and ventral margins setose as figured, 2 ventral and 1 dorsodistal spines. Dactylus slender, unguis finely pointed, the 2 together 0.75 times as long as propodus.

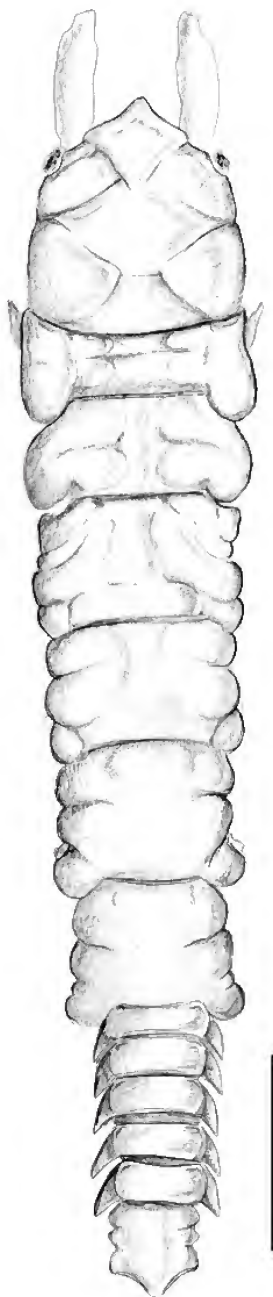


Figure 4. *Apseudes tuski* sp. nov., holotype female, dorsal. Scale line = 1mm.

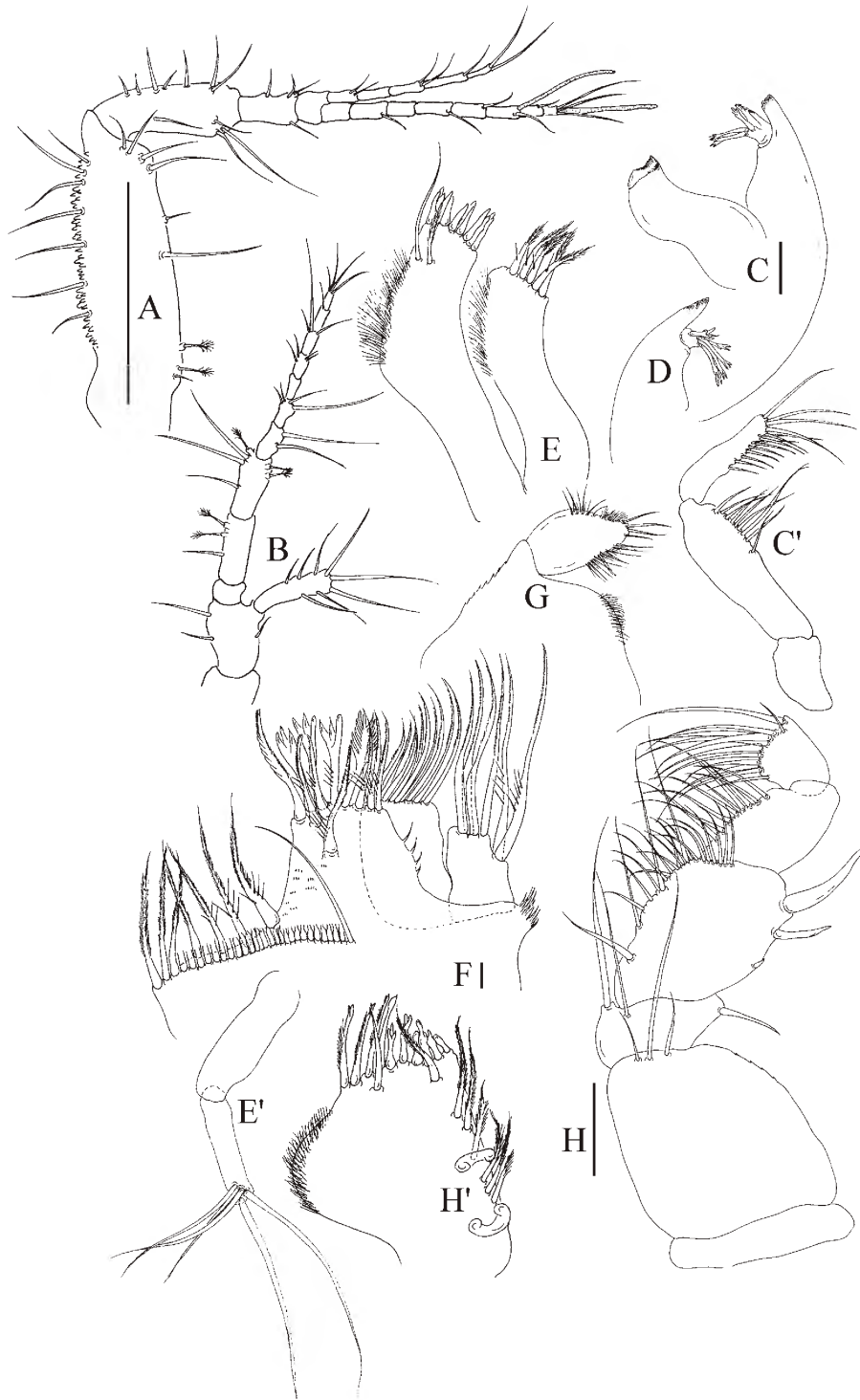


Figure 5. *Apsseudes tuski* sp. nov., A, antennule; B, antenna; C, left mandible; D, right mandible; E, maxillule; F, maxilla; G, labium; H, maxilliped; H', maxilliped endite. Scale line = 0.1mm.

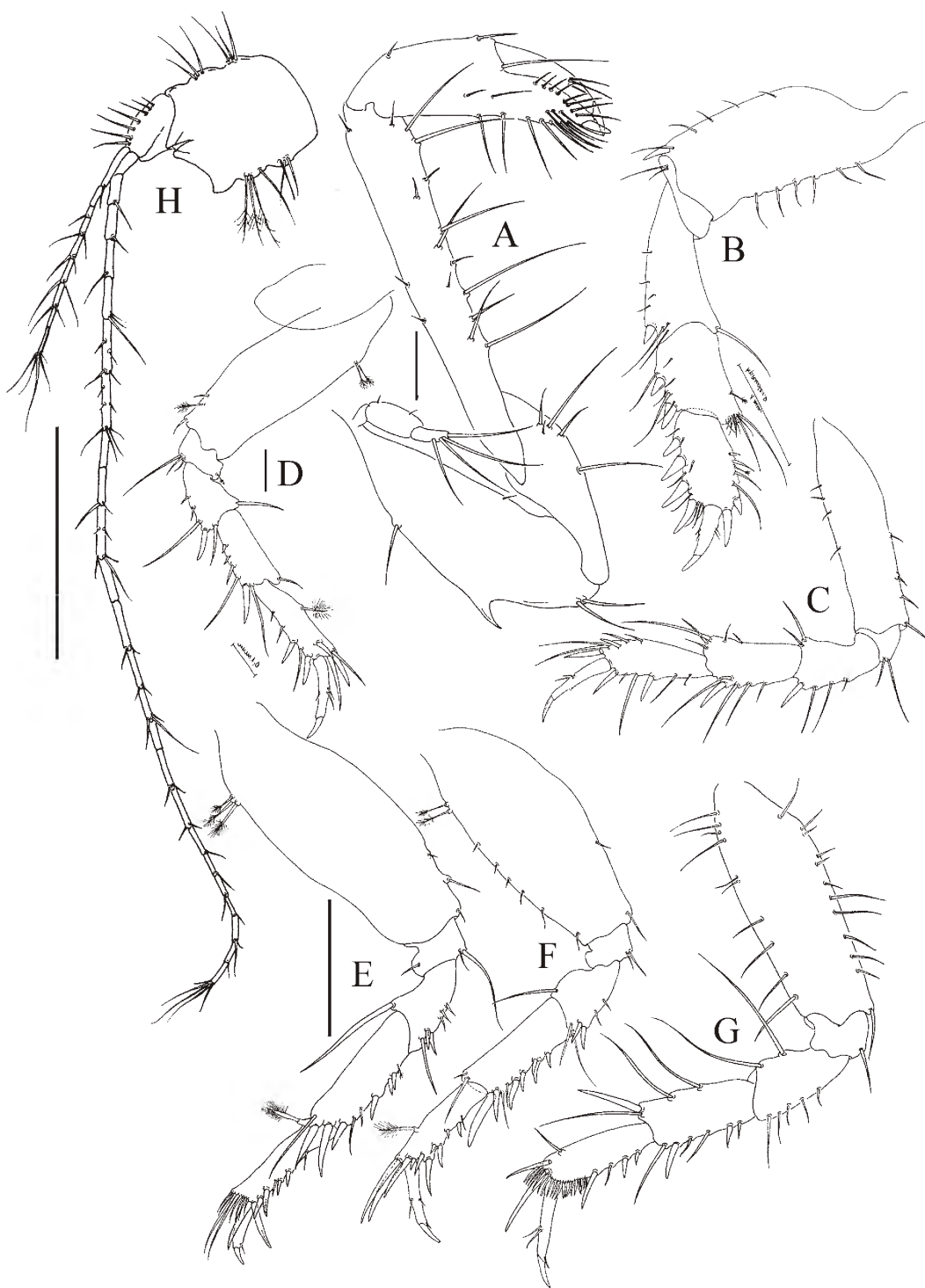


Figure 6. *Aapseudes tuski* sp. nov., A, cheliped; B–G, pereopods 1–6 respectively; H, pleotelson and left uropod. Scale line = 0.1mm.

Pereopod 3 similar to pereopod 2, but basis with penicillate seta, propodus with inner subdistal spine.

Pereopod 4 similar to pereopod 2 but basis stouter, 2.8 times as long as wide, without proximal hook-like apophysis, with dorsoproximal and ventrodistal penicillate setae, merus with midventral, ventrodistal and dorsodistal spines, carpus twice as long as merus, with midventral spines and distal crown of 4 spines about 0.5 as long as propodus, interspersed by longer setae; propodus with dorsodistal tuft of 2 short and 6 longer setae; dactylus plus unguis shorter than propodus but longer than longest dorsodistal propodal setae.

Pereopod 5 similar to pereopod 2, but without proximal hook-like apophysis, propodus with mid-dorsal penicillate seta and ventral row of 5 spines in distal half, dorsodistal setae as long as dactylus; dactylus and unguis slender, together as long as propodus.

Pereopod 6 basis with dorsal and ventral margins entirely setose, merus and carpus without spines, propodus with numerous ventral leaf-like propodal spines extending around distal margin of article.

Pleopods all alike. Basis elongate, with 4 ventral plumose setae, dorsal margin naked. Endopod longer than exopod; both rami slender, linguiform, with plumose setae.

Uropod biramous, both rami filiform, multi-segmented. Basis with 1 inner distal seta; exopod about 0.5 as long as endopod, with 13 segments; endopod elongate with 24 segments.

Male unknown.

Etymology. From the Latin *abditus* – hidden, secret, and *spina* – a thorn or spine, referring to the maxilliped palp inner spines and the proximal spiniform apophysis on the basis of pereopods 1 to 3 (noun in apposition).

Remarks. See above under generic remarks.

Genus *Apseudes* Leach 1814

Apseudes tuski sp. nov.

Figures 4–6

Material: Female, holotype (NMV J47119), 1 brooding female, Australia, Victoria, eastern Bass Strait, 43 km SE of Port Albert (38°53.42'S, 147°06.30'E), 58 m, 18/11/1981, (BSS 177), R.S. Wilson; Paratypes: 37 females (NMV J55748), same locality as holotype; 1 female dissected on slides (NMV J55942), same locality as holotype; 2 individuals (NMV J28577), eastern Bass Strait, 10.8 km E of eastern edge of Lake Tyers (37°50.55'S, 148°12.50'E), 25/09/1990, (MSL-EG 118), N. Coleman; 2 individuals (NMV J28625), Stn MSL-EG 58, eastern Bass Strait, 4.6 km S of Cape Conran (37°51.26'S, 148°43.44'E), 50 m, 28/09/1990, (MSL-EG 58), Marine Science Laboratories; 7 individuals (NMV J28624), Australia, Victoria, eastern Bass Strait, 5.3 km ESE of Pt. Ricardo (37°50.29'S, 148°40.35'E), 43 m, 28/09/1990, (MSL-EG 54), Marine Science Laboratories; 2 individuals (NMV J55781), Western Port, off Crib Point (38°21.10'S, 145°14.00'E), 18 m, 29/03/1965, (CPBS-0 60), A.J. Gilmour; 1 individual (NMV J55782), eastern Bass Strait, 28 km SSW of Marlo (37°59'S, 148°27'E), 51 m, 30/07/1983, (BSS 207), M.F. Gomon and R.S. Wilson; 2 individuals (NMV J28623), eastern Bass Strait, 15.1 km WSW of Pt. Ricardo (37°51.38'S, 148°28.14'E), 34 m, 26/09/1990, (MSL-EG 49); 1 individual (NMV J28575), eastern Bass Strait, 11.7 km W of Pt. Ricardo (37°49.53'S,

148°30.08'E), 27 m, 02/1991, (MSL-EG 103), N. Coleman; 1 ovi female, eastern Bass Strait, 8 km S of South East Point, Wilsons Promontory (39°12.54'S, 146°27.18'E), 65 m, 18/11/1981, (BSS 180), R.S. Wilson; 1 hermaphroditic, 81-T-1, Stn 166, (NMV J55784), eastern Bass Strait, 20 km SSW of Babel I. (40°06.48'S, 148°24.18'E), 22 m, 14/11/1981, (BSS 166), R.S. Wilson; 1 ovi female, (NMV J55785), western Bass Strait, 35 km SSW of Cape Otway, Victoria (39°07.00'S, 143°14.36'E), 84 m, 20/11/1981, (BSS 183), R.S. Wilson.

Description of female. Body dorsoventrally flattened, elongate, holotype 5.3 mm long (tip of rostrum to posterior of pleotelson), 5.2 times as long as wide, narrower posteriorly. Cephalothorax subrectangular, slightly longer than wide, anterior margin with conspicuous but blunt rostrum with rounded “shoulders” at base. Eyes present; eyelobes rounded; no lateral spiniform apophyses at anterior margin of branchial chambers. 6 free pereonites, all without lateral spiniform apophyses; pereonite 1 shortest, about one-quarter as long as cephalothorax, pereonite 2 1.5 times as long as pereonite 1, both with lateral margins uniformly convex; pereonites 3, 4 and 6 subequal, twice as long as pereonite 1, with anterolateral indentations reflecting dorsal sculpturing and expansions over coxae of pereopods; pereonite 5 just longest, 1.2 times as long as and of similar morphology to pereonite 4 (all pereonites respectively 4.0, 2.3, 1.7, 1.6, 1.4 and 1.5 times as wide as long); ventral hyposphenia on pereonites 2 and 6. Pleon twice as long as pereonite 5, of 5 free subequal pleonites bearing pleopods; pleonites dorsally convex, 2.5 times as wide as long, laterally expanded by spiniform apophyses. Pleotelson rectangular, short, one-third length of whole pleon, 1.1 times as long as wide, with bunches of lateral setae on similar rounded protuberances to those of pereonites 3 to 6.

Antennule peduncle 4-articled, article 1 3.2 times as long as wide, with inner margin denticulate, setose as figured; 2 0.45 times as long as 1st, with simple inner and longer outer-distal setae; 3 less than half length of article 2, article 4 half as long as article 3, naked. Main flagellum of 8 segments, segments 6 and 8 bearing aesthetascs; accessory flagellum of 5 segments.

Antenna peduncle article 1 simple; article 2 bearing 2 inner and 1 outer marginal seta and elongate squama with 8 marginal setae; peduncle article 3 as long as wide, naked; article 4 slightly longer than article 5, and 4 times as long as article 3. Flagellum of 7 segments.

Mouth parts. Labrum not seen. Left mandible with outer margin naked, bearing narrow crenulated pars incisiva and lacinia mobilis, setiferous lobe with 3 trifurcate setae, pars molaris robust, blunt; mandibular palp of 3 articles, article 1 naked, articles 2 and 3 with 9 ventral setae in distal half, distally with additional 4 longer simple setae. Right mandible as left but without lacinia mobilis. Maxillule inner endite with finely setose outer margin and 5 finely setulate distal setae; outer endite with 11 distal spines and 2 subdistal setae, outer margin finely setose; palp of 2 articles, distally with 5 setae. Maxilla with tuft of setae on outer margin; outer and inner lobes of outer endite with bilaterally setulose setae; outer lobe of inner endite with bilaterally setulose, plumose and trifurcate distal and subdistal spines as figured, outer margin denticulate, inner margin with microtrichia; inner lobe of fixed endite with rostral row of numerous setulose setae guarding 4 longer setae. Labium with fine serrations on outer margin and setulose

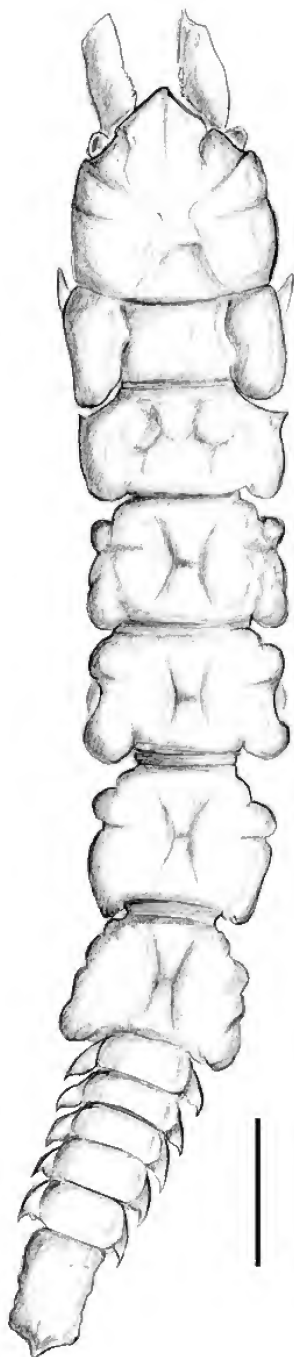


Figure 7. *Apseudes poorei* sp. nov., holotype female, dorsal. Scale line = 1mm.

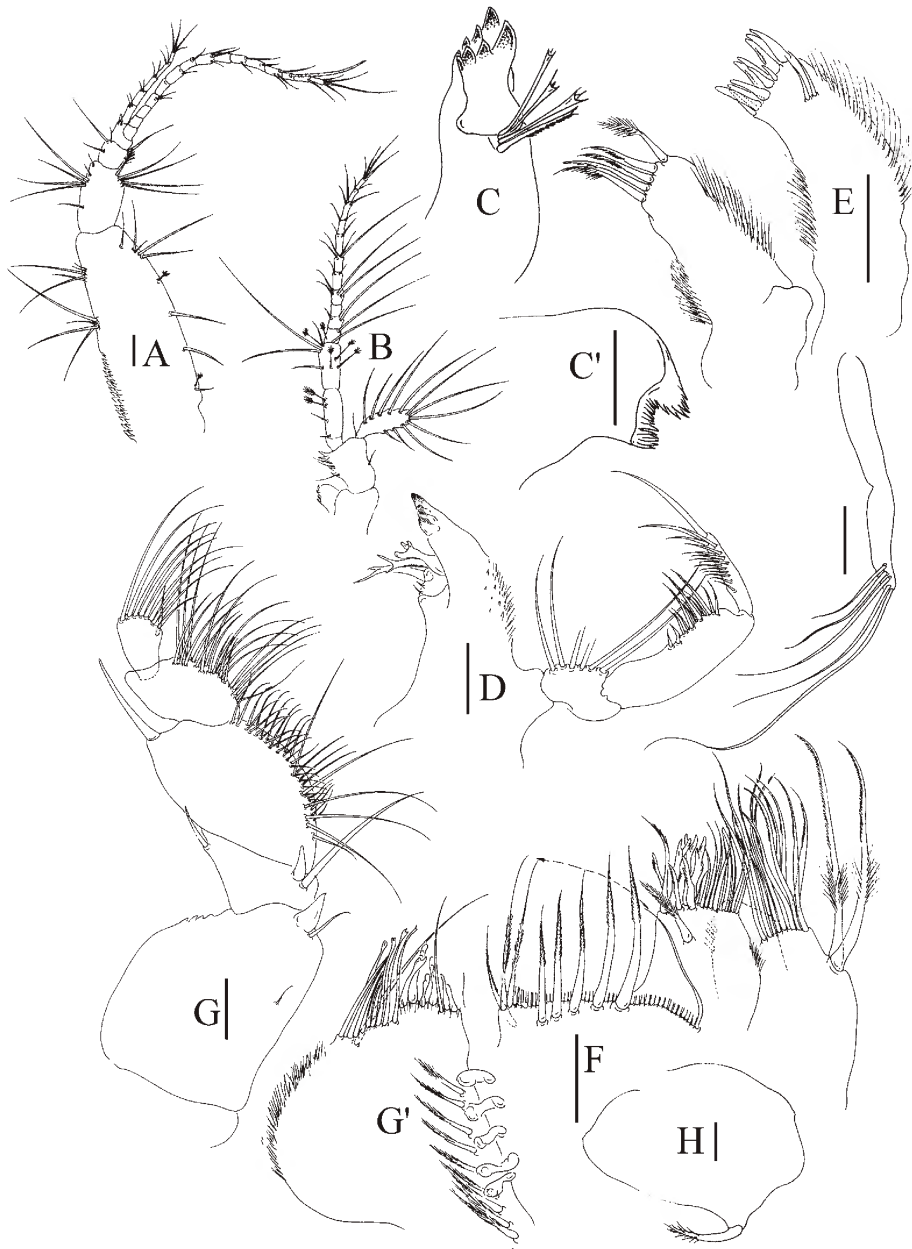


Figure 8. *Apseudes poorei* sp. nov., A, antennule; B, antenna; C, left mandible; C', pars molaris of same; D right mandible; E, maxillule; F, maxilla; G, maxilliped; G', maxilliped endite; H, epignath. Scale line = 0.1mm.



Figure 9. *Aapseudes poorei* sp. nov., A, cheliped; B–E, pereopods 1–4 respectively; F, pereopod 6; G, pereopod 5; H, pleopod; I, pleotelson and right uropod. Scale line = 0.1mm.

distal margin, palp with fine lateral setules and 3 simple distal setae. Maxilliped basis with 3 distal setae; palp article 1 with single inner and outer distal setae; palp article 2 longer than wide, with 2 rows of filtering setae on inner margin, the longest as long as article 3, outer margin with 3 spines, distal spine large and robust; palp article 3 longer than wide, with 9 simple setae along inner margin; palp article 4 with 10 distal setae, and single inner and outer subdistal setae. Maxilliped endite with setulose inner caudodistal seta and stout, spatulate, distal spines; 2 coupling hooks. Epignath not seen.

Cheliped slender. Basis 2.9 times as long as wide, dorsally with single fine seta, ventrally with simple proximal seta, midventral spine and 2 distal setae; exopodite present, 3-articled, article 2 with 2 setules, article 3 with 4 plumose setae. Merus elongate, narrowing proximally, with 1 midventral seta and 4 subdistal setae on ventral "shoulder". Carpus 6.6 times as long as wide, with sparse longer and shorter simple setae along ventral margin, short setae at mid-length and distally on dorsal margin. Chela fingers shorter than palm, ventral margin with 7 setae; 3 outer setae on fixed finger, cutting edge with 8 fine setae but no apophyses; dactylus with 3 subdistal setae but no apophyses on cutting edge, distal claw pointed.

Pereopod 1 with pronounced spine-like apophysis on coxa. Basis stout, 2.6 times as long as wide, with dorsal and ventral marginal setae and ventrodorsal spine; exopodite present, 3-articled, article 3 with 4 distal plumose setae. Ischium with 2 simple ventrodorsal setae. Merus half as long as basis, with ventrodorsal but no dorsodistal stout spine. Carpus 0.75 times as long as merus, with dense tuft of dorsodistal setae surrounding short, stout spine, ventrally with 2 stout spines. Propodus as long as carpus, with 4 ventral and 2 dorsodistal stout spines. Dactylus stout, with 2 middorsal fine setae and ventral denticulations; unguis short.

Pereopod 2 more slender. Basis 4 times as long as wide with sparse setae. Merus 0.9 times as long as carpus, with slender ventrodorsal spine. Carpus elongate, with dorsodistal seta as long as article, sparse setae otherwise, and ventrodorsal slender spine. Propodus as long as carpus, 2 ventral spines, dorsally with 1 distal and subdistal spines. Dactylus slender with fine dorsal setae, unguis slender, the 2 together just shorter than propodus.

Pereopod 3 similar to pereopod 2, but basis and propodus with penicillate setae, longest seta on ischium longer than merus.

Pereopod 4 basis more robust, twice as long as wide, with dorsoproximal penicillate setae, longest seta on ischium longer than merus, merus with 2 shorter ventrodorsal spines and long dorsodistal seta almost as long as carpus, carpus with paired ventral spines, longer distal spines; propodus with dorsoproximal penicillate seta, dorsodistal tuft of 6 short and 2 long finely denticulate setae, distal spines as long as dactylus; dactylus plus unguis two-thirds as long as propodus.

Pereopod 5 similar to pereopod 4; setae on ischium and merus proportionately shorter, dactylus plus unguis proportionately longer, propodus with dorsodistal spines.

Pereopod 6 basis with setae along entire dorsal and ventral margins, paired long dorsal setae on merus and carpus, carpus with slender dorsodistal spine, 18 ventral leaf-like propodal spines extending around distal margin of article.

Pleopods all similar, basis with 2 ventral and 1 dorsal plumose setae, rami elongate, inner ramus setose all round, outer ramus shorter, with naked inner proximal margin.

Uropod biramous, both rami filiform, multi-segmented. Basis with outer row of setae; exopod one-quarter as long as endopod, with 8 segments; endopod elongate, with about 24 segments.

Male unknown.

Etymology. The species is named after the Polish Prime Minister Donald Tusk who was elected as this species was being described..

Remarks. *Apseudes tuskii* sp. nov. is most similar to that group of *Apseudes sensu lato* with no spiniform apophyses on the cephalon or pereon, and rounded ocular lobes usually with eyes, similar to *A. latreilli* (Milne-Edwards, 1828) and *A. africanus* Tattersall, 1925. The new species appears closest to *A. erythraeicus* Băcescu, 1984 (q.v.) from the Red Sea, but that species has a dorsodistal spine on the merus, more articles in the antennular main flagellum, proportionately more compact antennular peduncle articles, more setae on the antennal squama and a pointed rostrum. Indeed, in the absence of a dorsodistal spine on the merus, *A. tuskii* approaches the genus *Apseudopsis* Norman, 1899 *sensu* Guțu (2006); however, the short cephalon, the presence of eyes and the multiarticulated uropod exopod prevent placing the present species in that essentially Mediterranean – North-Atlantic genus, and Guțu (2006) points out that the denticulation of the inner margin of the proximal antennular peduncle article, well-developed in *A. tuskii*, is a feature of *Apseudes sensu stricto*.

The comparatively blunt rostrum, and the relatively short, blunt marginal spines on pereopod 1, particularly the very short dorsodistal spine on the merus are valuable distinguishing features of *A. tuskii*, while the peculiar outer spination of the proximal maxilliped palp article appears to be unique.

Apseudes poorei sp. nov.

Figures 7–9

Material. Female, holotype (NMV J55747); Australia, Victoria, Western Port, off Crib Point (38°20.49'S, 145°13.51'E), 13 m, 30/03/1965, (CPBS-N 41), A.J. Gilmour. Paratypes: 1 female with oostegites, 1 juvenile, (NMV J53142), 2 specimens dissected on slides (NMV J55943), same locality as holotype; 1 male (NMV J55790), eastern Bass Strait, 8 km S of South East Point, Wilsons Promontory (39°12.54'S, 146°27.18'E), 65 m, 18/11/1981, (BSS 180), R.S. Wilson; 1 individual (NMV J55791), eastern Bass Strait, 37 km NNE of Eddystone Point (40°43.48'S, 148°37.12'E), 67 m, 14/11/1981, (BSS 164), R.S. Wilson; 2 individuals (1 adult male), (NMV J55792), Tasmania, eastern Bass Strait, 30 km N of North Point, Flinders I. (39°26.18'S, 147°48.42'E), 49 m, 17/11/1981, (BSS 173), R.S. Wilson; 3 individuals (NMV J55793), central Bass Strait, 35 km NE of Cape Wickham, (39°16.00'S, 144°05.24'E), 82 m, 23/11/1981, R.S. Wilson; 3 individuals (NMV J55794), central Bass Strait, 47 km E of Cape Rochon, Three Hummock I. (40°23.48'S, 145°32.00'E), 66 m, 03/11/1980, (BSS 113), M.F. Gomon and G.C.B. Poore; 2 manca, (NMV J55795), central Bass Strait, 47 km E of Cape Rochon, Three Hummock I. (40°23.48'S, 145°32.00'E), 66 m, 03/11/1980, (BSS 113), M.F. Gomon and G.C.B. Poore; 6 individuals (2 manca), (NMV J55796), eastern Bass Strait, 28 km SSW of Marlo (37°59'S, 148°27'E), 51 m, 30/07/1983, (BSS 207), M.F. Gomon and R.S. Wilson; 1 hermaphroditic, (NMV J55797),

central Bass Strait, 38 km SW of Cape Paterson (38°55.30'S, 145°17.00'E), 70 m, 12/11/1981, (BSS 155), R.S. Wilson; 1 individual, (NMV J55801), central Bass Strait, 38 km SW of Cape Paterson (38°55.30'S, 145°17.00'E), 70 m, 12/11/1981, (BSS 155), R.S. Wilson; 1 ovi female (with well developed genital cone), (NMV J55798), central Bass Strait, 44 km NE of Cape Wickham, King I. (39°22.00'S, 144°18.18'E), 60 m, 23/11/1981, (BSS 203), R.S. Wilson; 1 male (NMV J55799), Tasmania, eastern Bass Strait, 30 km N of North Point (39°26.18'S, 147°48.42'E), 49 m, 17/11/1981, (BSS 173), R.S. Wilson; 6 individuals (4 females ovi), (NMV J55800), central Bass Strait, 44 km NE of Cape Wickham, King I. (39°22.00'S, 144°18.18'E), 60 m, 23/11/1981, (BSS 203), R.S. Wilson.

Description of female. Body dorsoventrally flattened, elongate, holotype 10.1 mm long (tip of rostrum to posterior of pleotelson), 6.5 times as long as wide, narrower posteriorly. Cephalothorax subrectangular, almost subcircular, as long as wide, anterior margin with triangular, blunt rostrum with notches just anterior to ocular lobes. Eyes present; eyelobes rounded; no lateral spiniform apophyses at anterior margin of branchial chambers. 6 free pereonites, all without lateral spiniform apophyses; pereonite 1 shortest, 0.4 times length of cephalothorax, pereonite 2 half as long as cephalothorax, both with lateral margins uniformly convex, pereonite 2 with slightly angular anterolateral corners; pereonites 3 to 6 subequal in length (5th longest), 1.7 times as long as pereonite 1, indented behind anterolateral rounded shoulders and mostly expanded posterolaterally at attachment of coxae; all pereonites respectively 2.7, 1.8, 1.5, 1.5, 1.2 and 1.3 times as wide as long; ventral hyposphenium on pereonite 6. Pleon 2.4 times as long as pereonite 6, of 5 free subequal pleonites bearing pleopods; pleonites dorsally convex, 2.5 times as wide as long, laterally expanded by spiniform apophyses. Pleotelson rectangular, 0.4 times length of whole pleon, 1.6 times as long as wide, with numerous lateral setae.

Antennule peduncle 4-articled, article 1 2.7 times as long as wide, with denticulations along proximal half of inner margin, setose as figured; article 2 0.3 times as long as article 1, with inner and outer distal tufts of long setae; article 3 0.4 times as long as article 2, article 4 one-third as long as 3rd, naked. Main flagellum of 15 segments, segments 13 and 15 bearing aesthetascs; accessory flagellum of 5 segments.

Antenna peduncle article 1 with inner denticulate apophysis; article 2 bearing inner denticulations and elongate squama with 13 marginal setae; peduncle article 3 as long as wide, with 1 seta; article 4 slightly longer than article 5, both with penicillate setae. Flagellum of 11 segments, most proximal segments with long outer setae.

Mouth parts. Labrum not seen. Left mandible outer margin finely setose, bearing strongly denticulated pars incisiva and lacinia mobilis, setiferous lobe with 4 trifurcate setae; pars molaris robust, distally spinose. Right mandible as left but without lacinia mobilis; mandibular palp of 3 articles, article 1 longer than wide with 6 long setae along inner margin, article 2 nearly 3 times as long as article 1 with 2 rows of longer and shorter simple setae in distal half; article 3 half length of article 2 with numerous inner simple setae increasing in length towards tip of article, longer distal seta as long as article. Maxillule inner endite with finely setose outer and inner margins, rounded outer apophysis and 5 finely setulate distal setae; outer endite

with 11 distal spines and 2 subdistal setae, margins finely setose; palp of 2 stout articles, distally with 5 setae. Maxilla with smooth outer margin; outer lobe of outer endite with 2 setae on outer margin setulose at mid-length; other setae of outer endite simple; outer lobe of inner endite with simple setae, stout bifurcate and trifurcate spines and plumose inner and subdistal setae; inner lobe of fixed endite with rostral row of numerous setae guarding 5 longer setae. Labium not seen. Maxilliped basis with inner distal seta and stout spine; palp article 1 with seta on outer margin and inner distal seta and stout spine; palp article 2 longer than wide, with rows of numerous short setae and few proximal longer filtering setae on inner margin, outer margin with slender distal spine; palp article 3 longer than wide, with rows of filtering setae along inner margin; palp article 4 longer than wide, with 9 distal and 1 subdistal setae. Endite with flagelliform inner caudodistal seta and stout, spatulate, inner distal spines, slender compound outer spines and outer simple setae; 5 coupling hooks. Epignath large, cup-shaped, distal spine distally setulose.

Cheliped not slender. Basis 3.6 times as long as wide, dorsally with 3 plumose setae, ventrally with 3 proximal seta, midventral spine and tuft of 3 distal setae; exopodite present, 3-articled, article 2 naked, distal article with 5 plumose setae. Merus elongate, with 3 midventral and 4 subdistal setae. Carpus 4.2 times as long as wide, with 4 longer simple setae along ventral margin, sparse shorter setae along dorsal margin. Chela fingers shorter than palm, palm wider than long, ventral margin of fixed finger with dense row of setae; 4 setae near articulation of fixed finger and 2 at axis of gape; cutting edge of fixed finger with row of fine setules interspersing flat, rounded "teeth", but no apophyses, distal claw pointed; dactylus with 3 subdistal setae but no apophyses on cutting edge, distal claw pointed.

Pereopod 1 with pronounced, setose, spiniform apophysis on coxa. Basis stout, twice as long as wide, with dorsoproximal seta, ventrodistal setae and small ventrodistal spine; exopodite present, 3-articled, article 2 naked, article 3 with 5 distal plumose setae. Ischium with 2 simple ventrodistal setae. Merus 0.8 times as long as basis, with midventral group of 4 setae, and 4 dorsodistal simple setae surrounding slender spine, shorter, stouter ventrodistal spine. Carpus less than half as long as merus, as long as wide, with 2 ventral and 1 dorsodistal stout spines. Propodus longer than merus, with 3 ventral and 2 dorsal stout marginal spines interspersed with simple setae. Dactylus stout, with mid-dorsal fine seta, unguis short, both together 0.7 times as long as propodus.

Pereopod 2 more slender. Coxa without spiniform apophysis. Basis 3.5 times as long as wide with tuft of ventrodistal setae, plumose midventral setae and mid-dorsal penicillate seta. Merus 0.9 times as long as carpus, with groups of midventral, ventrodistal and dorsodistal setae and slender ventrodistal spine, inner distal seta as long as carpus; carpus with similar setation and spination. Propodus just longer than carpus, dorsally and ventrally setose, with 2 ventral, 2 inner and 1 dorsodistal spines. Dactylus slender with 2 dorsal setae, unguis slender, the 2 together just shorter than propodus.

Pereopod 3 similar to pereopod 2, but basis with long inner setae, carpus with inner distal spines.

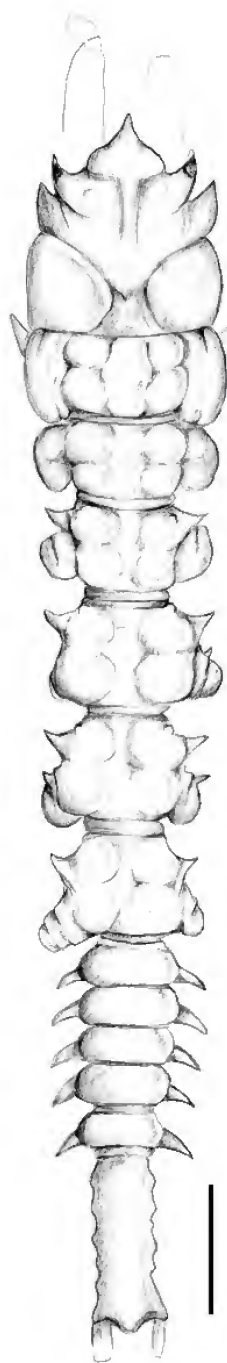


Figure 10. *Spinosapseudes colobos* sp. nov., holotype female, dorsal. Scale line = 1mm.

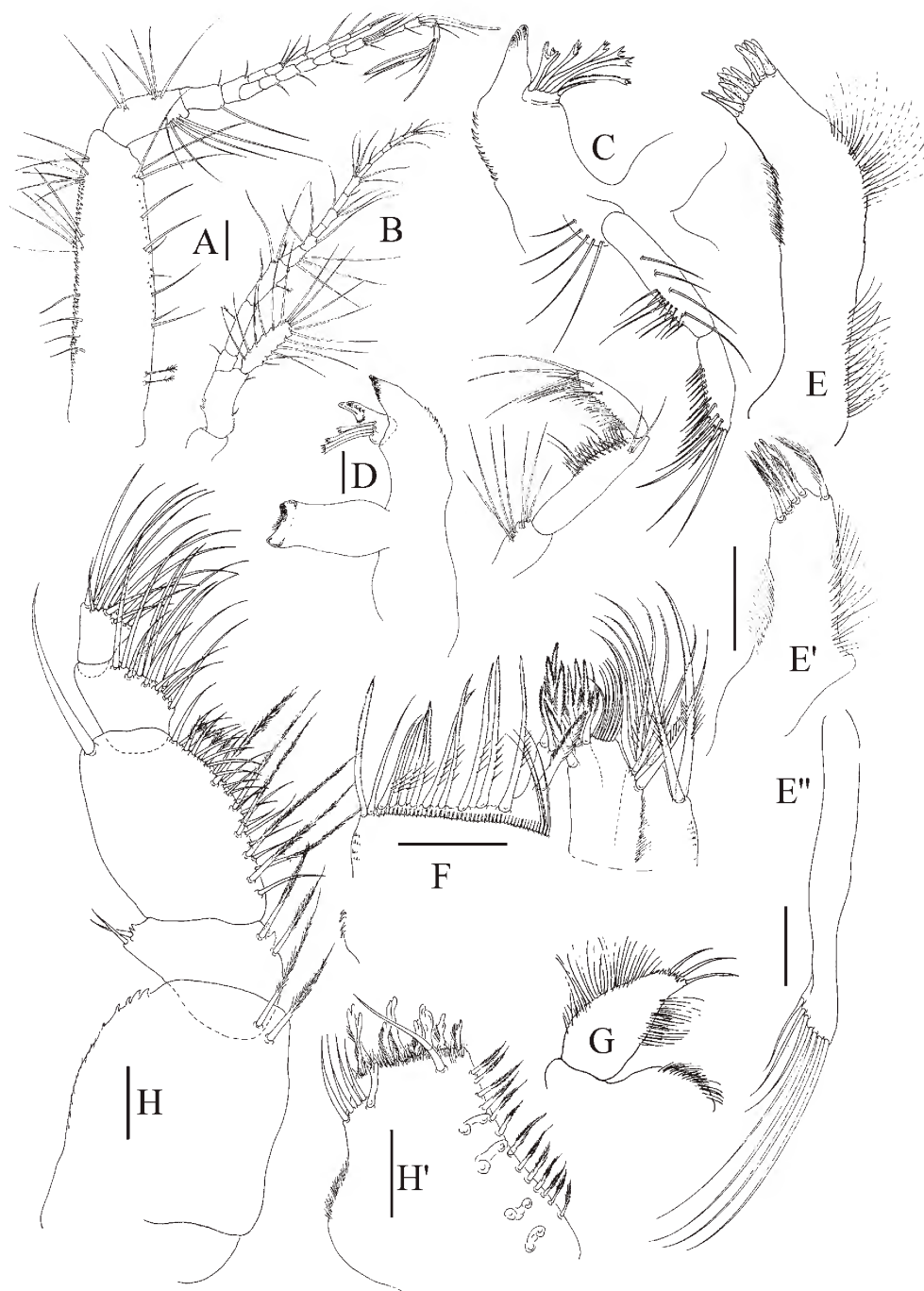


Figure 11. *Spinosapseudes colobos* sp. nov., A, antennule; B, antenna; C, right mandible; D, left mandible; E, maxillule; F, maxilla; G, labium; H, maxilliped; H', maxilliped endite. Scale line = 0.1mm.

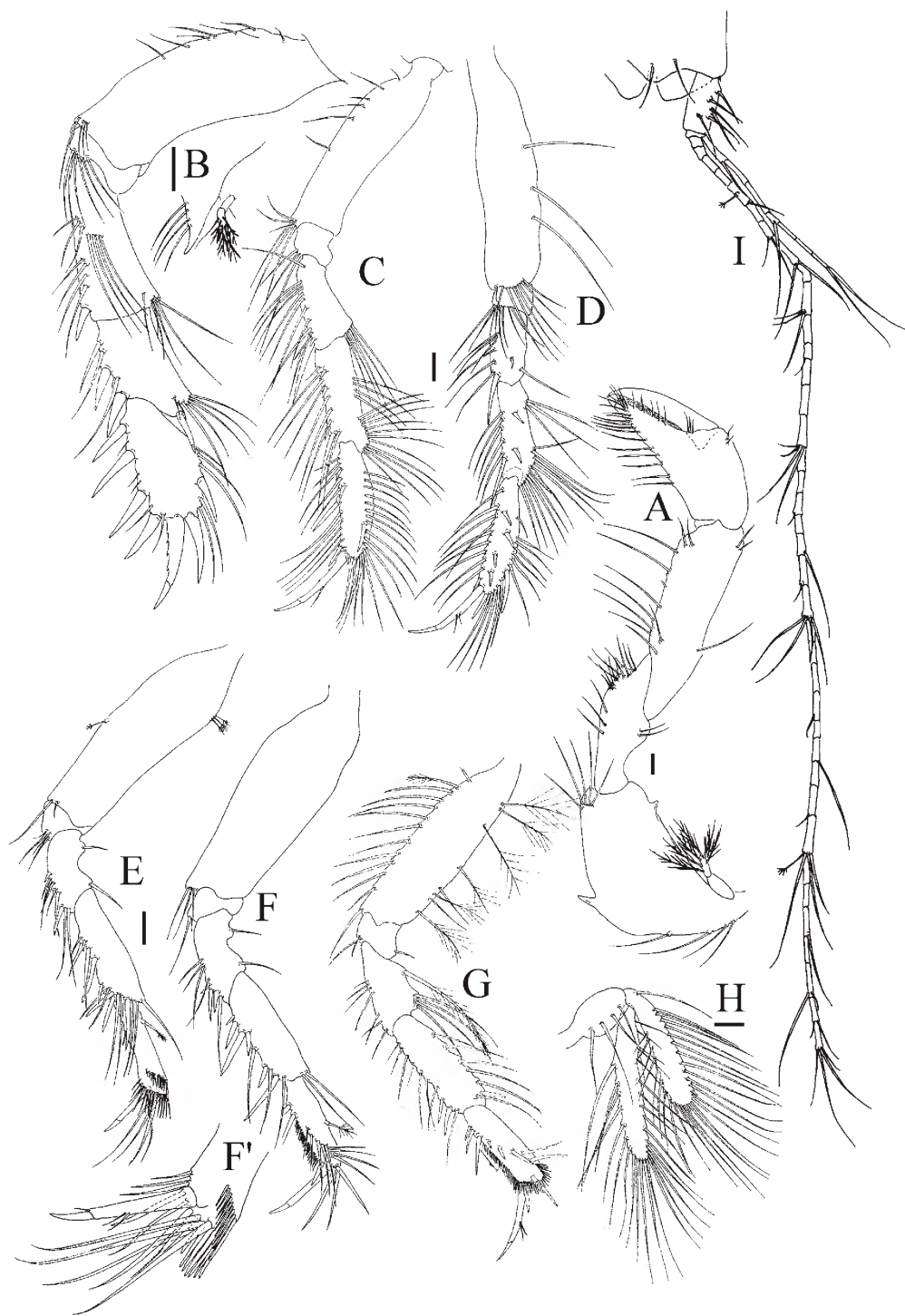


Figure 12. *Spinosapseudes colobos* sp. nov., A, cheliped; B–G, pereopods 1–6 respectively; H, pleopod; I, uropod. Scale line = 0.1mm.



Figure 13. *Spinosapseudes colobos* sp. nov., male cheliped. Scale line = 0.1mm.

Pereopod 4 basis stouter, 3 times as long as wide, with 2 plumose setae and dorsal and ventral penicillate setae; merus two-thirds as long as carpus with paired ventrodistal spines and longer dorsodistal spine; carpus dorsally naked, with paired ventral spines and ventrodistal spines amongst slender setae; propodus with dorsoproximal penicillate seta, 2 ventral spines amongst row of fine marginal setae, dorsodistal tuft of numerous short and 5 long fine setae; dactylus plus unguis shorter than propodus.

Pereopod 5 similar to pereopod 4, but basis with ventroproximal spine, simple dorsal setae; merus with slender dorsodistal and shorter, paired ventrodistal spines; propodus with ventral row of fine denticulations in proximal half.

Pereopod 6 basis with dorsal and ventral plumose marginal setae, merus without spines, propodus with 24 ventral leaf-like propodal spines extending to distal margin of article.

Pleopods all alike. Basis elongate, with 2 dorsal and 2 ventral plumose setae. Endopod slightly longer than exopod; both rami slender, with plumose marginal setae, largely confined to distal half on exopod.

Uropod biramous, both rami filiform, multi-segmented. Basis with long setae distally on inner and outer margins; exopod less than one-quarter as long as endopod, with 13 segments; endopod elongate, 5.5 times as long as pleotelson, with more than 40 segments.

Male unknown.

Etymology. Named for Gary Poore of Museum Victoria, who collected much of the material analysed herein, in gratitude for his assistance in making all the tanaidacean material held at Melbourne available for study.

Remarks. In many ways, *Apseudes poorei* sp. nov. is close to the previous species, *A. tuski*, with a generally similar body, mouthpart and pereopod morphology (although differing in detail); conversely, it too has inner distal spines on the maxilliped basis and proximal palp article, as found in *Annexos abditospina*, also described above (although there are few other similarities between that and the present species). Along with *A. bucospinosus*, there seems to be a common theme of maxilliped spination amongst the eastern Australian species of Apsuedinae. Other distinctions of *A. poorei* from *A. tuski* include the presence of a dorsodistal spine on the merus of pereopod 1, the extreme length of that merus, the proportionately longer pleotelson, 1 fewer ventral propodal spine on pereopod 1, longer flagella on the antennule and antenna, the inner apophysis on the proximal antennal peduncle article, a longer uropod endopod, and the presence of plumose setae on the bases of pereopods 2 and 4; all but the 1st of these also distinguish *Apseudes poorei* from the otherwise similar *A. erythraeicus* (see discussion under *A. tuski*).

Genus *Spinosaapseudes* Guṭu, 1996

Spinosaapseudes colobos sp. nov.

Figures 10–13

Material. Female, holotype (NMV J55746), Australia, Victoria, central Bass Strait, 66 km S of Rodondo I. (39°49.30'S, 146°18.30'E), 82 m, 13/11/1981 (BSS 158 G), R.S. Wilson. Paratypes: 1 male, allotype (NMV J55745), same locality as holotype; 10 females without oostegites, 5 males (NMV J47125), 1 female dissected, (J55944), same locality as holotype; 1 female (NMV J55767), Victoria, central Bass Strait, 26 km SE of Aireys Inlet (38°39.48'S, 144°18.12'E), 79 m, 19/11/1981, R.S. Wilson; 5 females, 7 males, 17 juveniles (NMV J55768), central Bass Strait, 100 km SSE of Cape Liptrap, Victoria (39°45.54'S, 145°33.18'E), 74 m, 13/11/1981, R.S. Wilson; 3 females, 5 males, 2 manca (NVM J55769), central Bass Strait, 100 km SSE of Cape Liptrap, Victoria (39°45.54'S, 145°33.18'E), 74 m, 13/11/1981, R.S. Wilson; 1 female (NMV J55770), central Bass Strait, 65 km ENE of Cape Rochon, Three Hummock I. (40°10.54' S, 145°44.18' E), 75m, 13/11/1981, (BSS 157), R.S. Wilson; 1 male (NMV J55771), Victoria, central Bass Strait, 26 km SE of Aireys Inlet (38°39.48'S, 144°18.12'E), 79 m, 19/11/1981, R.S. Wilson; 4 female, 4 males (NMV J55772), Tasmania, central Bass Strait, 47 km E of Cape Rochon, Three Hummock I. (40°23.48'S, 145°32.00'E), 66 m, 03/11/1980, (BSS 113), M.F. Gomon and G.C.B. Poore; 1 juvenile (NMV J55773) Tasmania, central Bass Strait, 47 km E of Cape Rochon, Three Hummock I. (40°23.48'S, 145°32.00'E), 66 m, 03/11/1980, (BSS 113), M.F. Gomon and G.C.B. Poore, 4 females, 5 males, 8 manca (NMV J55775), eastern Bass Strait, 63 km E of North Point, Flinders I. (39°44.48'S, 148°40.36'E), 124 m, 14/11/1981, (BSS 167), R.S. Wilson; 1 male (NMV J55774) eastern Bass Strait, 20 km SSW of Babel I. (40°06.48'S, 148°24.18'E), 22 m, 14/11/1981, (BSS 166), R.S. Wilson.

Description of female. Body dorsoventrally flattened, elongate, holotype 9.5 mm long (tip of rostrum to posterior of pleotelson), 6.7 times as long as wide, narrower posteriorly. Cephalothorax subrectangular, 1.2 times as long as wide, anterior margin with conspicuous pointed rostrum with rounded “shoulders” at base. Eyes present; eyelobes modified to prominent spine-like apophyses directed anterolaterally; conspicuous lateral spiniform apophyses at anterior margin of branchial chambers. 6 free pereonites; pereonites 1 and 2 subequal, about 0.4 times as long as cephalothorax, lateral margins uniformly convex; pereonite 3 as long as pereonite 2, with anterolateral spine-like apophyses and expanded posterolaterally at attachment of coxae; pereonites 4, 5 and 6 subequal (4 longest), 1.2 times as long as pereonite 2, with anterolateral spine-like apophyses and expanded posterolaterally at attachment of coxae (all pereonites respectively 2.3, 2.0, 1.6, 1.3, 1.25 and 1.25 times as wide as long); ventral hyposphenia present on all pereonites. Pleon 3.6 times as long as pereonite 6, of 5 free subequal pleonites bearing pleopods plus pleotelson; pleonites 2.54 times as wide as long, laterally expanded by spiniform apophyses. Pleotelson long and slender, almost half length of whole pleon, 2.8 times as long as wide, lateral margins undulating, with paired distal setae.

Antennule peduncle article 1 elongate, 3.7 times as long as wide, setose as figured, inner margin finely corrugated; article 2 0.3 times as long as article 1, with 2 groups of inner marginal setae and tuft of outer distal setae, longest of these longer than article; article 3 half length of article 2, with long outer seta; article 4 half as long as article 3, with inner distal seta. Main

flagellum of 15 segments, segments 10, 12 and 13 bearing aesthetascs; accessory flagellum of 6 segments.

Antenna peduncle article 1 simple; article 2 twice as long as wide, with proximal inner and outer marginal denticulations and 2 outer setae, and bearing elongate squama with 16 marginal setae; peduncle article 3 as long as wide, with 1 seta; article 4 slightly longer than article 5, and 3 times as long as article 3, with inner penicillate seta; article 5 with outer penicillate seta and simple and penicillate setae at inner distal corner. Flagellum of 11 segments.

Mouth parts. Labrum rounded, simple setose. Right mandible with outer margin finely denticulate, bearing strong, crenulated pars incisiva, setiferous lobe with 7 distally compound setae and 1 simple seta, pars molaris robust, blunt, distally with marginal spinules; mandibular palp of 3 articles, article 1 just longer than wide with row of 5 inner setae; article 2 5 times as long as wide with 2 parallel rows of inner simple setae in distal 3rd and row of 4 mesial setae in distal half; article 3 about two-thirds as long as article 2 with row of inner simple setae increasing in length towards distal end of article, 3 distal mesial setae, and 3 longer distal setae. Left mandible as right but with crenulate lacinia mobilis. Maxillule inner endite marginally setose with outer blunt apophysis, distally with 5 plumose spines; outer endite with 1 shorter (“dwarfed” *sensu* Lang, 1968) and 12 longer stout and blunt distal spines and 2 subdistal setae, outer and inner margins finely setose; palp of 2 articles, distally with 7 setae. Maxilla with microtrichia on outer margin; outer lobe of outer endite with 2 setae with mid-length setulation on outer margin, distally with 9 similar setae; inner lobe of outer endite with curved simple setae; outer lobe of inner endite with setulose spines distally and subdistally; inner lobe of fixed endite with rostral row of numerous setae guarding 10 longer setae with mid-length setulation, innermost seta finely bilaterally denticulate. Labium with setulose distal margin, palp with conspicuous lateral setules and 3 fine distal setae. Maxilliped basis irregularly serrated on outer distal margin and with 2 inner distal plumose setae; palp article 1 with 2 outer distal setae and 2 plumose inner setae; palp article 2 longer than wide, with rows of numerous shorter simple and longer plumose setae on inner margin, outer margin with simple strong distal seta; palp article 3 longer than wide, with numerous simple setae along expanded inner margin; palp article 4 with 13 distal setae. Endite with 4 coupling-hooks, simple outer distal setae, simple whip-like inner caudodistal seta and stout, spatulate, distal spines (“chitinous formations” *sensu* Lang, 1968). Epignath not seen.

Cheliped relatively slender. Basis 1.75 times as long as wide, dorsally with spine-like apophysis in distal half, ventrally with proximal setae, midventral spine and tuft of 5 distal setae; exopodite present, 3-articled, distal article with 6 setae. Merus elongate, with paired dorsal and 3 mid-ventral setae, ventrodorsal spine-like apophysis amongst tuft of setae. Carpus more than 3 times as long as wide, with row of setae along ventral margin mostly longer than carpal width, 1 proximal and 2 distal simple setae on dorsal margin. Chela fingers about as long as palm, ventral margin with 10 setae, 7 distal setae around claw of fixed finger; 3 setae near articulation of fixed finger; dactylus slender, as long as fixed finger, distal claw pointed.

Pereopod-1 with pronounced spine-like apophysis on coxa. Basis stout, 2.8 times as long as wide, with ventral setae in proximal half, tuft of ventrodiscal setae and short spine; exopodite present, 3-articled, article 3 with 5 distal setae. Ischium with 5 simple ventrodiscal setae. Merus two-thirds as long as basis, with rows of 7 ventral setae and 4 fine outer mesial setae, 4 dorsodistal simple setae, ventrodiscal spine. Carpus shorter than merus, with dorsodistal spine adjacent to group of long simple setae, and ventrally with 2 spines in distal 0.5 interspersed with simple setae. Propodus half as long as carpus plus merus, with 2 dorsal spines, longer dorsal setae, 4 ventral spines. Dactylus slender, about 0.7 length of propodus, with ventral denticulations; unguis short.

Pereopod 2 more slender, basis 3.9 times as long as wide. Merus 0.9 times as long as carpus, with elongate setae along ventral margin, but restricted to distal corner dorsally. Carpus elongate, with rows of ventral and dorsal setae. Propodus just shorter than carpus, similarly setose but with 1 submarginal dorsal and ventrodiscal spine. Dactylus slender with fine subdistal seta, with unguis and dactylus as long as propodus.

Pereopod 3 similar to pereopod 2, but basis with longer marginal setae, carpus and propodus with mesial spines.

Pereopod 4 coxa with spine-like apophyses, basis 3.6 times as long as wide, with penicillate setae, merus with sinuous dorsal margin and 2 ventral spines amongst longer setae, carpus 1.7 times as long as merus with ventral and distal spines and setae, distal setae more than half as long as propodus; propodus shorter than carpus, with proximo-dorsal penicillate seta, subdistal and distal rows of short setae, 4 longer distal setae exceeding unguis; dactylus plus unguis shorter than propodus.

Pereopod 5 similar to pereopod 4, coxa with apophyses, distal short setae forming a crown around tip of propodus.

Pereopod 6 similar to pereopod 5, but basis with rows of marginal setae, ventrally simple but dorsally plumose; merus with single plumose dorsal seta; carpus with simple dorsal marginal setae; propodus with ventroproximal and mesial short spines, row of fine leaf-like spines around dorsal margin and along distal two-thirds of ventral margin.

Pleopods all alike. Basis with 4 inner (ventral) plumose setae. Endopod longer than exopod without proximal articulation; both rami slender, with numerous marginal plumose setae. Inner proximal seta on endopod more robust.

Uropod biramous, both rami filiform, multi-segmented. Basis with row of outer setae; exopod one-fifth as long as endopod, with 7 segments; endopod elongate, with about 40 segments.

Male. Slightly larger than female (dissected specimen 10.3 mm long); sexual dimorphism shown by an increased number of aesthetascs on the antennule, and large ventral penial tubercle on pereonite 6. Cheliped more robust, basis 1.5 times as long as wide; carpus subtriangular, only slightly longer than wide; propodus stout, longer than carpus plus merus, fixed finger with conspicuous proximal tooth-like apophysis on cutting edge; dactylus with smaller proximal apophysis on cutting edge.

Etymology. From the Greek *kolobos* – shortened, with reference to the articles of the antennular and antennal peduncles and mandibular palp, and the pereopod bases, being conspicuously shorter than those of the generotype *S. setosus* (Lang, 1968).

Remarks. Of the numerous species attributed to the genus *Apseudes sensu lato* (including *Spinosaapseudes* Guțu, 1996 and *Tuberapapseudes* Băcescu and Guțu, 1971), only 13 have a conspicuous spine-like apophysis anterior to the branchial chamber, and, apart from *A. bruneinigma* Bamber, 1999, all have a telson at least twice as long as wide and anterolateral spine-like apophyses on pereonites from 3 to 6. Only 5 of these, *A. abyssalis* Błażewicz-Paszkowycz and Larsen, 2004, *A. rotundifrons* Băcescu, 1981, *A. tenuimanus* Sars 1882, *A. (Tuberapapseudes) echinata* Sars 1882, and *A. setosus* Lang, 1968, have no dorsodistal spine on the merus of pereopod 1, and of these only *A. setosus* has the combination of a strongly pointed rostrum, more than 5 segments in the antennule accessory flagellum, and ventral but no dorsal setae on the pleopod basis.

Guțu (1996) erected the genus *Spinosaapseudes* for *A. setosus* Lang, 1968 (until now monotypic), named after the large spine-like apophyses on the cephalon and pereonites, and on the coxae of the posterior pereopods, and distinguished by the morphology of pereopod 1 being more similar to that of *Carpoapseudes* species, rather than the fossorial (i.e. apparently adapted for digging) appearance of this pereopod in *Apseudes sensu stricto* (as in the type species *A. talpa* Montagu, 1808).

While the present species shows a more fossorial morphology to its pereopod 1, it has numerous features in common with *Spinosaapseudes setosus*, notably the coxa 1 apophyses of the posterior pereopods, but also the plumose dorsal setae on pereopod 6, the spine-like apophyses of pereonites 3 to 6 and of the cheliped merus, the chaetotaxy of the mouthparts and pleopods, and the number of segments in antennular and antennal flagella and uropod exopod. *Spinosaapseudes colobos* sp. nov. is accordingly placed in the same genus, but, in addition to the pereopod 1 morphology, is clearly distinguished from *S. setosus* by the proportionately more compact articles of the antennular and antennal peduncles, the mandibular palp and the pereopods. Both species are only known from the Tasman Sea – Bass Strait region.

Genus *Gollumudes* Bamber, 2000

Gollumudes larakia (Edgar, 1997)

Apseudes larakia Edgar, 1997, 279–286, figs 1–3.

Gollumudes larakia. Guțu, 2006: 97–99.

Material. 4 individuals (J47131), Australia, Tasmania, eastern Bass Strait, 37 km NNE of Eddystone Point (40°43.48'S, 148°37.12'E), 67 m, 14/11/1981, (BSS 164), R.S. Wilson; 1 individual (J53143), 50 m south of Twin Reefs, Venus Bay (38°41'S, 145°39'E), 9 m, 07/03/1982, (CPA 7), M. McDonald; 1 individual (NVM J55756), western Bass Strait, 30 km SSW of Warrnambool (38°38.12'S, 142°35.00'E), 59 m, 20/11/1981, (BSS 188), R.S. Wilson; 3 individuals (NVM J55757), western Bass Strait, 15 km S of Port Fairy (38°32.00'S, 142°28.36'E), 52 m, 20/11/1981, (BSS 187), R.S. Wilson; 1 individual (NVM J55760), western Bass Strait, 15 km S of Port Fairy (38°32.00'S, 142°28.36'E), 52 m, 20/11/1981, (BSS 187), R.S. Wilson; 2 individuals (NVM J55764), western Bass Strait, King I., 59 km W of Stokes Point (40°07'S, 143°14'E), 185 m, 11/10/1980, (BSS 104), G.C.B. Poore; 2 individual (NVM J55766), Victoria, western Bass Strait, 5 km S of Point Reginald (38°48.00'S, 143°14.30'E), 47 m, 20/11/1981, (BSS

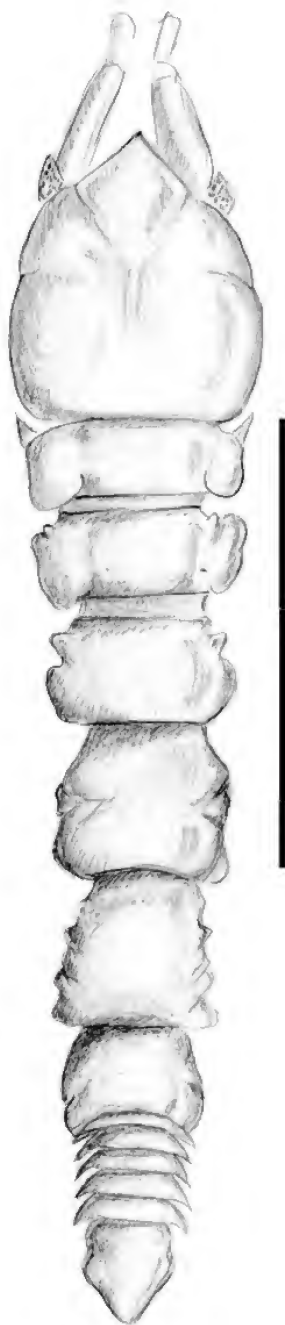


Figure 14. *Pugiodactylus syntomos* sp.nov., holotype female, dorsal. Scale line = 1 mm.

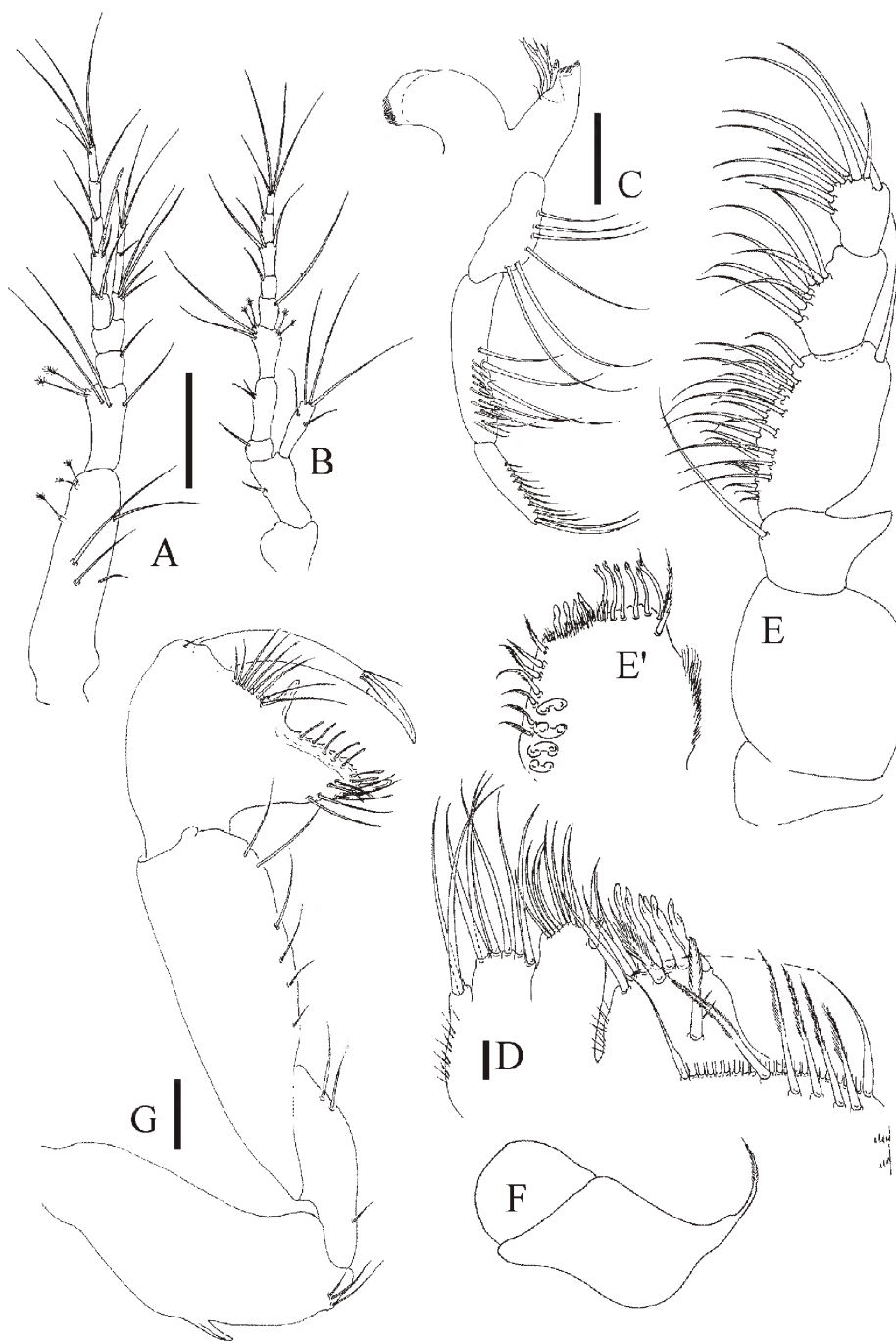


Figure 15. *Pugiodactylus syntomos* sp. nov., A, antennule; B, antenna; C, mandible; D, maxilla; E, maxilliped; E', maxilliped endite; F, epignath; G, cheliped. Scale line = 0.1 mm.

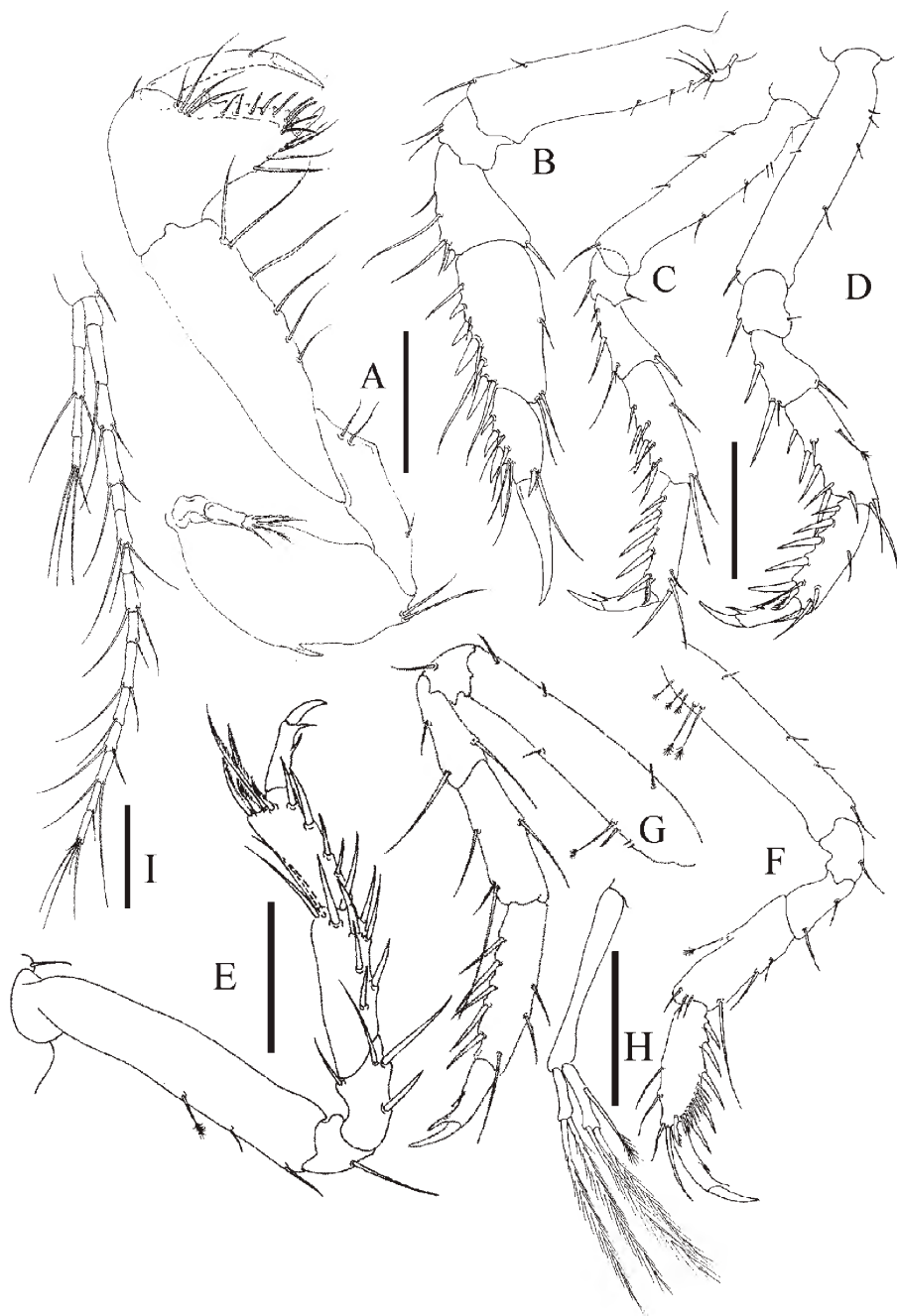


Figure 16. *Pugiodactylus syntomos* sp. nov., A, cheliped; B to E, pereopods 1 to 4 respectively; F, pereopod-6; G, pereopod-5; H, pleopod; I, uropod. Scale line = 0.1 mm.

185), R.S. Wilson; 1 individual (NVM J55758), western Bass Strait, 5 km SW of Bluff Point (40°48.06'S, 144°38.00'E), 42 m, 02/02/1981, (BSS 126 G), M.F. Gomon; 1 individual (NVM J55759), 50 m E of Petrel Rock, Venus Bay (38°39'S, 145°42'E), 8 m, 05/03/1982, (CPA 1) M. McDonald and M.F. Gomon; 5 individuals (NVM J55761), 1 km E of Harmers Haven, 500 m offshore (38°34'S, 145°40'E), 11 m, 06/03/1982, (CPA 14), C. Larsen and G. Barber, 1 individual (NVM J55762), 1 km E of Harmers Haven, 300 m offshore (38°34'S, 145°40'E), 6 m, 06/03/1982 (CPA 15), R.S. Wilson and C. Larsen; 1 individual (NVM J55763), Cape Paterson E side (38°41'S, 145°36'E), 6 m, 05/03/1982, (CPA 12), R.S. Wilson, G. Barber, et al.; 1 individual (NVM J55765) Bennison Channel 1.0 km S of Granite I. (38°49'S, 146°23'E), 6.0 m, 23/11/1983, (CIN 28), G.J. Morgan.

Remarks. Guțu (2001) corrected the description of this species, pointing out that, contrary to that description, both cheliped and pereopod 1 have an exopodite. Edgar (1997) recorded large numbers of this species in shallow water (1–8 m depth) around Darwin, Northern Territory, in association with algae and coral rubble. Guțu (2006) and Bamber (in press) recorded specimens from Moreton Bay, Queensland, also in shallow water. The present material extends the range of this species further south to Bass Strait, and to substantially greater depth.

Subfamily **Pugiodactylinae** Guțu 1995

Genus **Pugiodactylus** Guțu 1995

Pugiodactylus syntomos sp. nov.

Figures 14–16

Material. Female, holotype (NVM J55749), Australia, Tasmania, western Bass Strait, 59 km W of Stokes Point, King I. (40°07'S, 143°14'E), 185 m, 11/10/1980, (BSS 104 G), G.C.B. Poore. Paratypes: 2 females, 1 male (NVM J47118), same locality as holotype; 1 specimen dissected on slides (NVM J55941), western Bass Strait, King I., 59 km W of Stokes Point (40°07'S, 143°14'E), 185 m, 11/10/1980 (BSS 104), G.C.B. Poore; 4 individuals (NMV J55786), eastern Bass Strait, 70 km ENE of North Point, Flinders I. (39°28.24'S, 148°41.48'E), 110 m, 28/03/1979, (BSS 35), G.C.B. Poore; 1 female with rudimental oostegites, 3 males, 2 juveniles, 1 manca. (NMV J55787), eastern Bass Strait, 85 km NE of North Point, Flinders I. (39°02.24'S, 148°30.36'E), 120 m, 15/11/1981, (BSS 169), R.S. Wilson; 1 ovi female, 1 male, (NMV J55788), Victoria, western Bass Strait, 5 km S of Point Reginald, Victoria (38°48'S, 143°14.30'E), 47 m, 20/11/1981, (BSS 185), R.S. Wilson; 1 ovi females, 1 male (NMV J55789), 50 m S of Twin Reefs, Venus Bay (38°41'S, 145°39'E), 9 m, 07/03/1982, (CPA 7), M. McDonald.

Description of female. Body (fig. 14), dorsoventrally flattened, elongate, holotype 2.6 mm long (tip of rostrum to posterior of pleotelson), 5.6 times as long as wide, narrower posteriorly. Cephalothorax subcircular, slightly longer than wide, naked, anterior margin with conspicuous triangular pointed rostrum. Eyes and eyelobes present. 6 free pereonites; pereonite 1 shortest, 0.3 times as long as cephalothorax, lateral margins straight, coxal apophyses of pereopod 1 evident; pereonite 2 1.25 times as long as pereonite 1 with rounded anterolateral tubercle on each side; pereonite 3 with anterolateral spine-like apophyses, 1.5 times as long as pereonite 1; pereonite 4 slightly longer than pereonite 3, subrectangular; pereonite 5 longest, twice as long as pereonite 1; pereonite 6 simple, narrowest, just longer than pereonite 1 (all

pereonites respectively 2.7, 2.1, 1.5, 1.2, 1.0 and 1.6 times as wide as long). Pleon 2.5 times as long as pereonite 6, of 5 free subequal pleonites bearing pleopods plus pleotelson; pleonites more than 4 times as wide as long, laterally expanded by spiniform apophyses. Pleotelson pentagonal, half length of whole pleon, 1.2 times as long as wide.

Antennule slender, peduncle article 1 elongate, 4 times as long as wide, with 2 longer dorsal simple setae, 2 shorter inner simple setae, and 3 subdistal outer penicillate setae; article 2 0.35 times as long as article 1, distally with 3 simple setae at least as long as article 2 and 2 outer penicillate setae; article 3 less than half length of article 2 with inner distal seta; article 4 two-thirds as long as article 3, naked. Main flagellum of 5 segments, segment 2 with 1 aesthetasc; accessory flagellum of 3 segments.

Antenna proximal article-4 naked; article 2 with simple inner seta and bearing elongate squama with 5 marginal setae; peduncle article 3 shorter than wide, with 1 inner seta; article 4 slightly longer than article 5, and 3 times as long as article 3; article 5 with paired elongate inner distal simple setae, and outer and inner distal pairs of penicillate setae. Flagellum of 5 segments.

Mouth parts. Labrum not seen. Mandible with strong, crenulated pars incisiva, small lacinia mobilis, setiferous lobe with 5 mainly bifurcate setae, pars molaris stout with denticulate distal margin; mandibular palp of 3 articles, article 1 3 times as long as wide with 6 ventral setae, distal 4 setae longer than article; article 2 slender, 1.3 times as long as article 1, with 2 parallel rows of 5 longer and 9 shorter simple setae in distal half; article 3 0.6 times as long as of article 2 with 9 inner simple setae increasing in length distally, 2 longer distal setae as long as article. Maxillule (not figured) outer endite with setose margins and 10 distal spines, inner endite with outer apophysis and 4 plumose distal spines. Maxilla with fine setae on outer margin; outer lobe of moveable endite with 2 simple setae on outer margin and 6 simple distal setae; inner lobe of movable endite with simple distal setae; outer lobe of fixed endite with 3 simple setae, 5 blunt spines (inner 3 bifurcate) and 2 subdistal finely denticulate spines; inner lobe of fixed endite with rostral row of 22 setae guarding 5 longer plumose setae. Labium not seen. Maxilliped basis naked; palp article 1 with single inner distal seta as long as article 2, and outer blunt, triangular apophysis; palp article 2 longer than wide, with 2 rows of numerous filtering setae on inner margin, 1 outer distal seta longer than article 3; palp article 3 nearly twice as long as wide, with 7 inner simple setae; palp article 4 with 9 inner and distal setae. Endite with simple distal setae, slender outer bifurcate spines and stout, spatulate, inner spines; 4 coupling hooks. Epignath large, cup-shaped, with distally setulose distal seta.

Cheliped basis twice as long as wide, dorsally naked, ventrally with midventral apophysis and 1 longer and 1 shorter distal setae; exopodite present, 3 articulated, distal article with 4 to 6 marginal setae. Merus elongate, with single proximal and 2 distal ventral setae. Carpus 2.5 times as long as wide, with 2 shorter proximal and 3 longer distal simple setae along ventral margin. Chela as long as carpus; propodus wide, with 2 dorsal setae, 3 longer distal setae at insertion of dactylus, fixed finger with 3 ventral setae, 2 subdistal setae and row of 6 slender setae along cutting edge, cutting edge crenulated and armed

with fine spinules and small, proximal tooth-like apophysis (stronger in male); dactylus longer than fixed finger, with fine setae but no apophyses on cutting edge, distal claw pointed.

Pereopod-1 with pronounced spine-like apophysis on coxa. Basis 4.2 times as long as wide, with 3 proximal penicillate setae on dorsal margin, ventrally subdistal and distal simple setae; exopodite present, 3-articled, article 3 with 5 distal setae. Ischium with 2 simple ventrodiscal setae. Merus 0.3 times as long as basis, wider distally, with ventrodiscal spine, 4 ventral setae and 1 dorsodistal simple seta. Carpus stout, nearly twice as long as merus, with 4 ventral marginal spines interspersed with simple setae, dorsally with single central and paired distal simple setae. Propodus as long as merus, ventral margin with 4 spines interspersed with simple setae, single dorsodistal spine and seta. Dactylus and unguis fused, naked, 1.4 times as long as propodus.

Pereopod-2 more slender. Basis 4.7 times as long as wide; ischium slightly longer than wide, with single dorsal and ventral setae. Merus 0.6 times as long as carpus, with 4 ventral setae and single dorsodistal seta. Carpus with 3 ventral spines in distal 0.5 interspersed with simple setae, dorsal setae as pereopod 1. Propodus as long as carpus, with 5 slender ventral spines, 3 dorsodistal setae and distal pectinate spine. Dactylus with fine distal seta, unguis slender, shorter than dactylus, the 2 together 0.7 times as long as propodus.

Pereopod 3 similar to pereopod 2.

Pereopod 4 similar to pereopod 2 but basis with midventral penicillate seta, merus proximally naked, merus half length of carpus, carpus with 8 slender ventral spines in 2 rows; propodus with dorsodistal tuft of 5 finely denticulate setae.

Pereopod 5 similar to pereopod 2 but carpus without spines.

Pereopod 6 similar to pereopod 5, but basis with dorsoproximal group of 5 penicillate setae, propodus with row of 8 ventral leaf-like spines in distal half.

Pleopods 5 pairs, all alike, but progressively smaller towards the posterior; basis attenuated, naked; slender rami each with 2 plumose distal setae, outer ramus longer and with additional single dorsal plumose seta.

Uropod biramous, both rami filiform, multi-segmented. Basis with 1 inner distal seta; exopod 0.3 times as long as endopod, with 4 segments; endopod elongate, with 15 segments.

Male. Essentially as female, small penial tubercle ventrally on pereonite 6; dimorphism of the cheliped, male cheliped being slightly more robust, with larger tooth proximal of midpoint of cutting edge of fixed finger, dactylar setal row of 9 setae.

Etymology. From the Greek – *syntomos* – meaning shortened, as, compared with other species in the genus, are the cheliped carpus, pereopod 1 merus and carpus, the antenna and the rostrum of the present species.

Remarks. There are 4 previously described species of *Pugiodactylus*, all from the general region of Australasia, *P. antarcticus* (Beddard, 1886) from the Antarctic at 8–232 m depth, *P. agarthus* Gütu and Iliffe, 1997 from Niue I., South Pacific in 2 m, *P. coralensis* Gütu, 1998, from Malaysia (1–3 m depth), and *P. daicovicii* Gütu, 2006, from Moreton Bay, Australia (depth not given, probably between 5 and 15 m). Unlike the present species, all the others have a conspicuous slender pointed tip to the rostrum and slender articles and squama on the antenna. Only *P. agarthus*

has as few segments in the uropod exopod as *P. syntomos* sp. nov., but that species has far more segments in the antennular flagella.

Overall, and perhaps not surprisingly, *P. syntomos* is most similar to the other eastern Australian species, *P. daicovicii* (of which no description is given for the mouthparts, unfortunately), but a clear distinction, other than the robustness of the merus and carpus of pereopod 1 in the present species (merus as long as its distal width, compared with twice as long in *P. daicovicii*; vide Gütu, 2006), is that *P. daicovicii* has no pleopods. The stout chela of *P. syntomos* is typical of the genus, but the cheliped carpus of this species is far shorter than those of the other species, none of which have the elongate outer distal seta on article 2 of the maxilliped palp (not known for *P. daicovicii*).

Family **Whiteleggiidae** Gütu 1972

Genus **Whiteleggia** Lang 1970

Whiteleggia multicarinata (Whitelegge, 1901)

Apseudes multicarinata. Whitelegge, 1901: 203, 204–208
Whiteleggia multicarinata. Lang, 1970, 605–615, figs 3–8.

Material. 19 females, 8 males (NVM J55755). Australia, Tasmania, central Bass Strait, 20 km NNE of North Point, Flinders I. (40°38'S, 145°23'E), 37 m, 04/11/1980, (BSS 117), M.F. Gomon and G.C.B. Poore; 33 females, 17 males (NVM J47123 eastern Bass Strait, 63 km E of North Point, Flinders I. (39°44.48'S, 148°40.36'E), 124 m, 14/11/1981, (BSS 167), R.S. Wilson; 2 males, 1 female (NVM J53139), eastern Bass Strait, 63 km E of North Point, Flinders I. (39°44.48'S, 148°40.36'E), 124 m, 14/11/1981, (BSS 167), R.S. Wilson.

Remarks. The only previous published records of this species are of the type material, off New South Wales, Australia, at 37 to 108 m depth, and further specimens described by Lang (1970) from Dr Th. Mortensen's Pacific Expedition in 1914. Lang (1970) cited the sampling site as off South Africa (35°05'S 15°05'E), but those coordinates are a misprint: the sampling on that date was from the *Endeavour*, at 37°05'S 150°05'E, on sand and mud in depths of 70 to 100 m, i.e. off Merimbula, New South Wales (see numerous references to the sample site in, for example, Augener, 1924). Thus, reassuringly, all records of this species are from off south-eastern Australia. The present material extends the range further south and west, and into slightly deeper water. Much of the present material was collected together with the following species; distinction of the females is particularly difficult, the only reliable feature being the short peduncular articles of the antenna in *Pseudowhiteleggia typica*.

Genus **Pseudowhiteleggia** Lang, 1970

Pseudowhiteleggia typica Lang, 1970

Pseudowhiteleggia typica Lang, 1970, 616–626, figs 9–15.

Material. 24 females (8 ovigerous), 10 males (NMV J47121), Australia, Victoria, central Bass Strait, 65 km S of Cape Schanck (39°08.18'S, 144°43.54'E), 66 m, 23/11/1981, (BSS 201 G), R.S. Wilson; 17 females (NMV J53138), Tasmania, central Bass Strait, 20 km NNE of North Point, Flinders I. (40°38'S, 145°23'E), 37 m, 04/11/1980 (BSS 117), M.F. Gomon and G.C.B. Poore, 24 females, 9 males (NMV J55754),

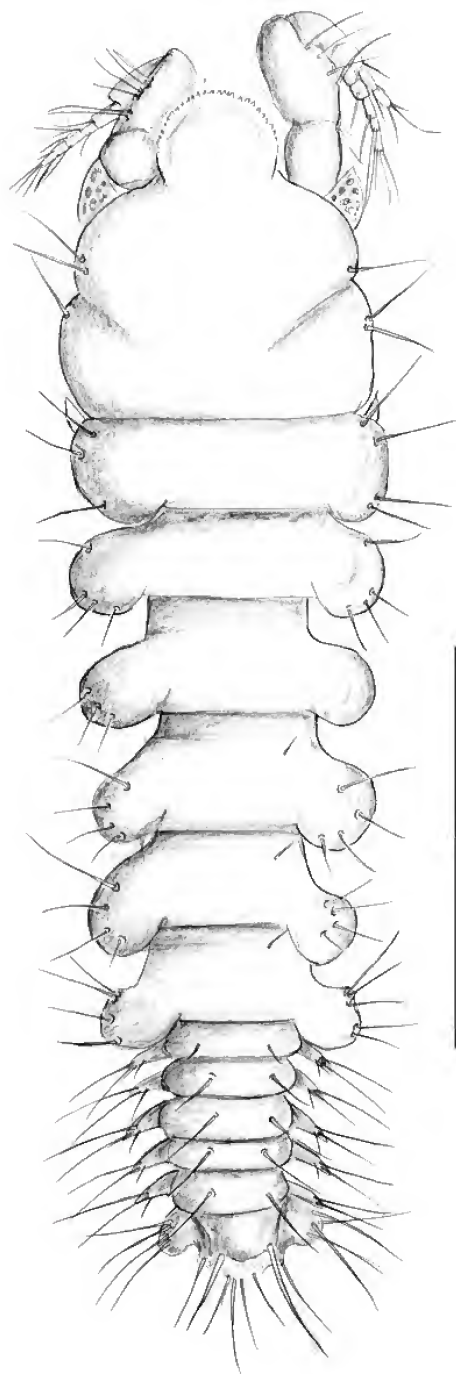


Figure 17. *Labraxeudes heliodiscus* gen. et sp. nov., holotype female, dorsal. Scale line = 1mm.

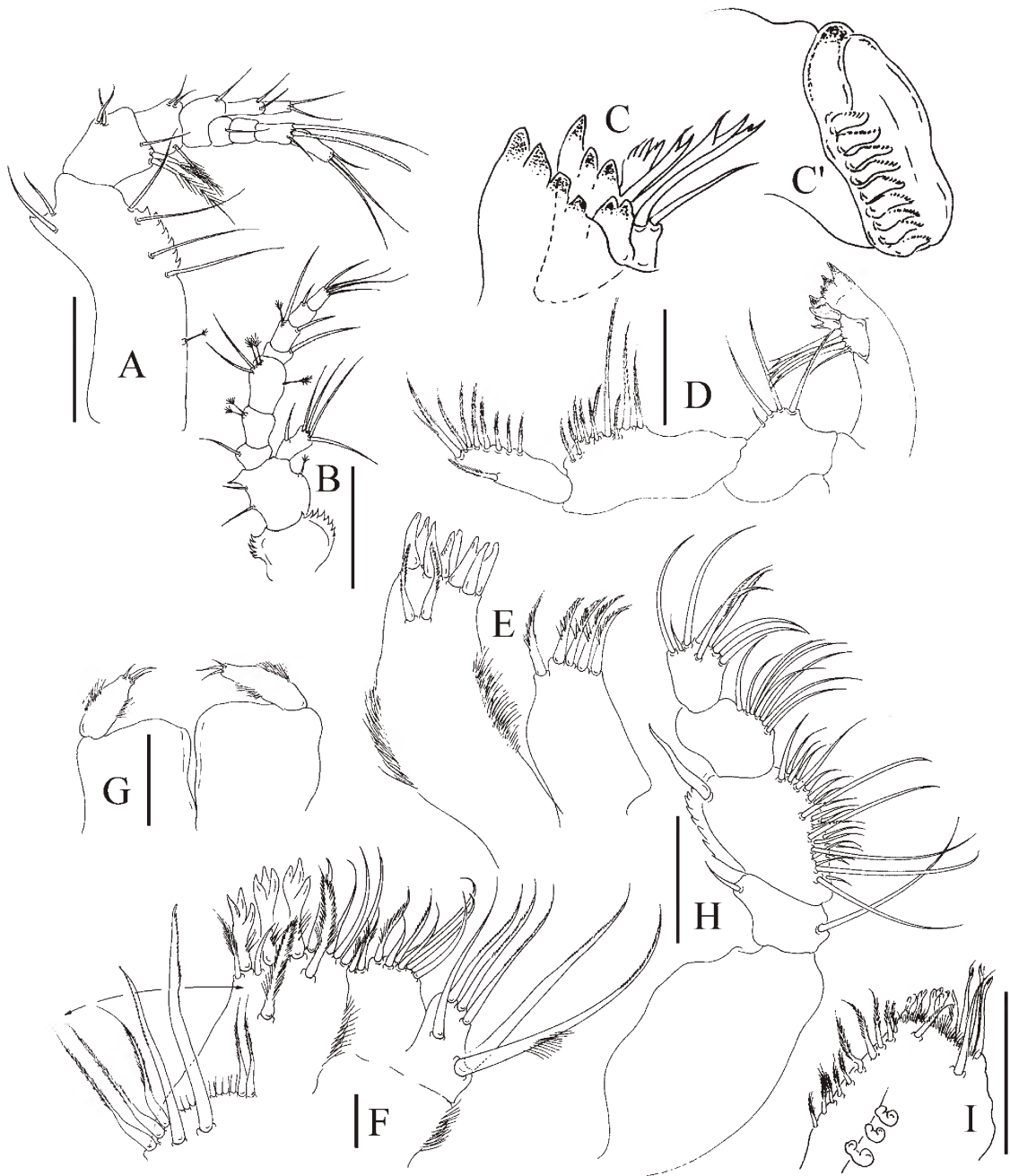


Figure 18. *Labraxeudes heliodiscus* gen. et sp. nov., A, antennule; B, antenna; C, left mandible, with detail of pars incisiva, lacinia mobilis, setal lobe and molar process; D, right mandible; E, maxillule; F, maxilla; G, labium; H, maxilliped; I, maxilliped endite. Scale line = 0.1 mm.

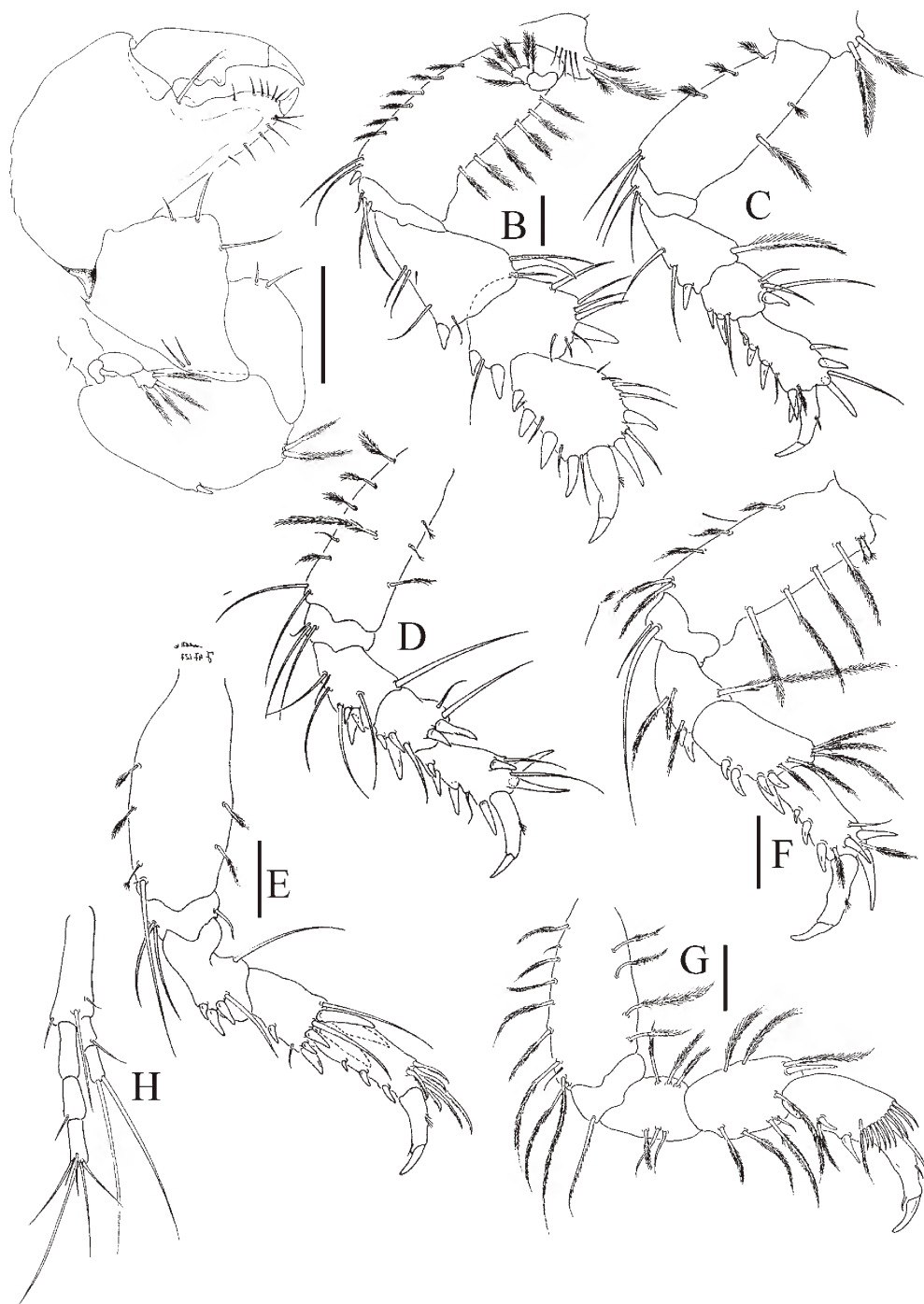


Figure 19. *Labraxeudes heliodiscus* gen. et sp. nov., A, cheliped; B–G, pereopods 1–6 respectively; H, uropod. Scale line = 0.1 mm.

western Bass Strait, 35 km SSW of Cape Otway, Victoria (39°07.00'S, 143°14.36'E), 84 m, 20/11/1981, (BSS 183), R.S. Wilson.

Remarks. This species would seem not to have been recorded since the type material described by Lang, collected from *Galathea* station 544 at 50 m depth off the east coast of Australia (29°57'S 153°22'E).

Family **Metapseudidae** Lang 1970

Subfamily **Metapseudinae** Lang 1970

Genus **Labraxeudes** gen. nov.

Diagnosis. Metapseudid with conspicuous rostrum, lateral simple setae on cephalon and pereonites, denser simple setae on pleonites and pleotelson, pleotelson with large, rounded lateral apophyses; antennule compact, without spine-like apophyses along inner margin of proximal peduncle article, flagella of few articles; antenna basal peduncle articles compact, little or not longer than wide, with squama; mandible with palp; cheliped robust, with exopodite; pereopod 1 with exopodite, coxa with rounded spine-like apophysis, basis with plumose setae but without dorsal apophyses; 5 pairs of pleopods; uropods of few segments.

Etymology. From - *labrax* - the Greek for a sea-bass (also the specific name of the sea-bass, *Dicentrarchus labrax*), a pun on Bass Strait, the region of the type locality, and a suffix from *Apsu*.

Type species. *Labraxeudes heliodiscus* sp. nov. by original designation.

Remarks. This genus has morphological similarities with *Apsu*, *Cyclopoapseudes* Menzies, 1953, and *Julmarichardia* Guţu 1989, lying somewhere between the last 2; the first 2 of these genera are without exopodites on the cheliped or pereopod 1, and numerous details of the rostrum, pereopod and uropod morphology are inconsistent, although the unusual pleotelson morphology mirrors that of species of *Cyclopoapseudes*. *Julmarichardia* species have a slightly similar rostrum morphology and do have exopodites on the cheliped and pereopod 1; however, that genus is characterized by having the propodus of pereopods 2 to 6 substantially longer than the carpus, by the proximal antennule peduncle article having inner spine-like apophyses, by the basis of pereopod 1 having marginal apophyses dorsally and by a slender antenna.

The combination of substantial rostrum, exopodites on the cheliped and pereopod 1, compact antenna, short uropod, simple pereonite setation, compact propodi, dorsum of pereopod 1 basis without apophyses, robust cheliped and antennule peduncle without inner row of conspicuous denticulation shown by *Labraxeudes* gen. nov. is unique amongst Metapseudinae.

Labraxeudes heliodiscus sp. nov.

Figures 17–19

Material. Brooding female, holotype (NVMJ47127), Australia, Victoria, Red Rock, Phillip I. (38°28'S, 145°14'E), 29/09/1974, W.F. Seed, B.

Leonard, B and R. Lennie; 2 females, paratypes (NVM J55750), 1 dissected on slides (NVM J55940) same sample as holotype.

Description of female. Body compact, holotype 2.9 mm long (tip of rostrum to posterior of pleotelson), 3.8 times as long as wide, narrower posteriorly. Cephalothorax subrectangular, as long as wide including rostrum (1.3 times as wide as long without rostrum), anterior margin with conspicuous subcircular, flattened rostrum with finely denticulate anterior margin. Eyes present on robust eyelobes; paired lateral setae behind eyelobes and on laterally swollen branchial chambers. 6 free pereonites, all with lateral margins uniformly convex, appearing as posterolateral rounded apophyses on pereonites 3 to 6, each with 3 or 4 conspicuous simple setae; pereonite 1 about one-third as long as cephalothorax; pereonite 2 shortest, 0.9 times as long as pereonite 1; pereonites 3 and 4 subequal (4th longest), 1.3 times as long as pereonite 1; pereonites 5 and 6 subequal, as long as pereonite 1 (all pereonites respectively 3.4, 3.8, 2.6, 2.4, 2.9 and 2.7 times as wide as long). Pleon 2.6 times as long as pereonite 1, of 5 free subequal pleonites bearing pleopods plus pleotelson; pleonites dorsally convex, more than 3 times as wide as long, with paired mid-dorsal setae, laterally expanded by spiniform apophyses each bearing 3 simple setae distally. Pleotelson distally rounded, one-quarter as long as whole pleon, expanded laterally into rounded apophyses bearing long simple setae, thus 2.5 times as wide as long, long paired dorsal simple setae in posterior half, distal margin with 3 long simple setae on each side.

Antennule peduncle article 1 arcuate, compact, 2.7 times as long as wide, inner margin with triangular subdistal apophysis bearing 2 simple setae, outer margin with proximal penicillate seta, fine denticulations in distal 3rd with row of 4 adjacent simple setae; article 2 one-third as long as article 1, with outer distal pair of plumose setae, dorsodistal simple seta and inner subdistal pair of shorter simple setae; article 3 half length of article 2, with outer distal plumose seta and inner subdistal pair of shorter simple setae; article 4 0.7 times as long as article 3, with inner distal seta. Main flagellum of 4 segments, segment 3 bearing single aesthetasc; accessory flagellum of 2 segments, each with 2 distal setae.

Antenna peduncle article 1 with inner denticulate apophysis and rounded denticulate outer margin; article 2 1.4 times as long as article 1, inner margin bearing pair of simple setae and subdistal spinous apophysis, outer margin with penicillate seta and distal squama with 5 simple marginal setae; peduncle article 3 shorter than wide, one-quarter the length of article 2, with 1 inner seta; article 4 twice as long as article 3, with paired inner penicillate setae; article 5 slightly longer than article 1, with inner and outer penicillate setae and paired inner simple setae. Flagellum of 4 segments.

Mouth parts. Labrum not seen. Left mandible bearing strong, crenulate pars incisiva, lacinia mobilis robust with 5 strong denticulations, setiferous lobe with 1 compound, 3 bifurcate and 1 simple setae, pars molaris robust, blunt, margin with row of finely denticulate teeth; mandibular palp of 3 articles, article 1 just longer than wide with 4 setae on inner rounded apophysis, article 2 1.75 times as long as article 1 with 3 longer and 7 shorter finely denticulate setae in distal half; article 3 two-thirds length of article 2 with 8 inner finely denticulate setae in distal half and

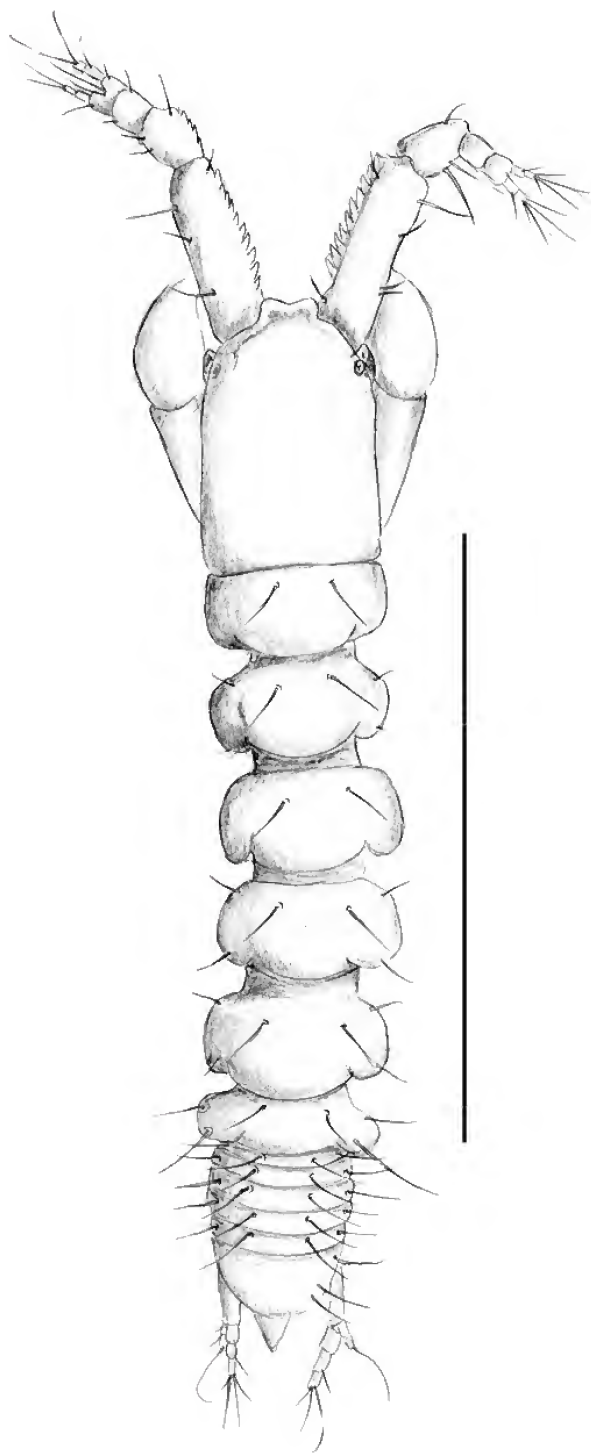


Figure 20. *Metapseudes wilsoni* sp. nov.

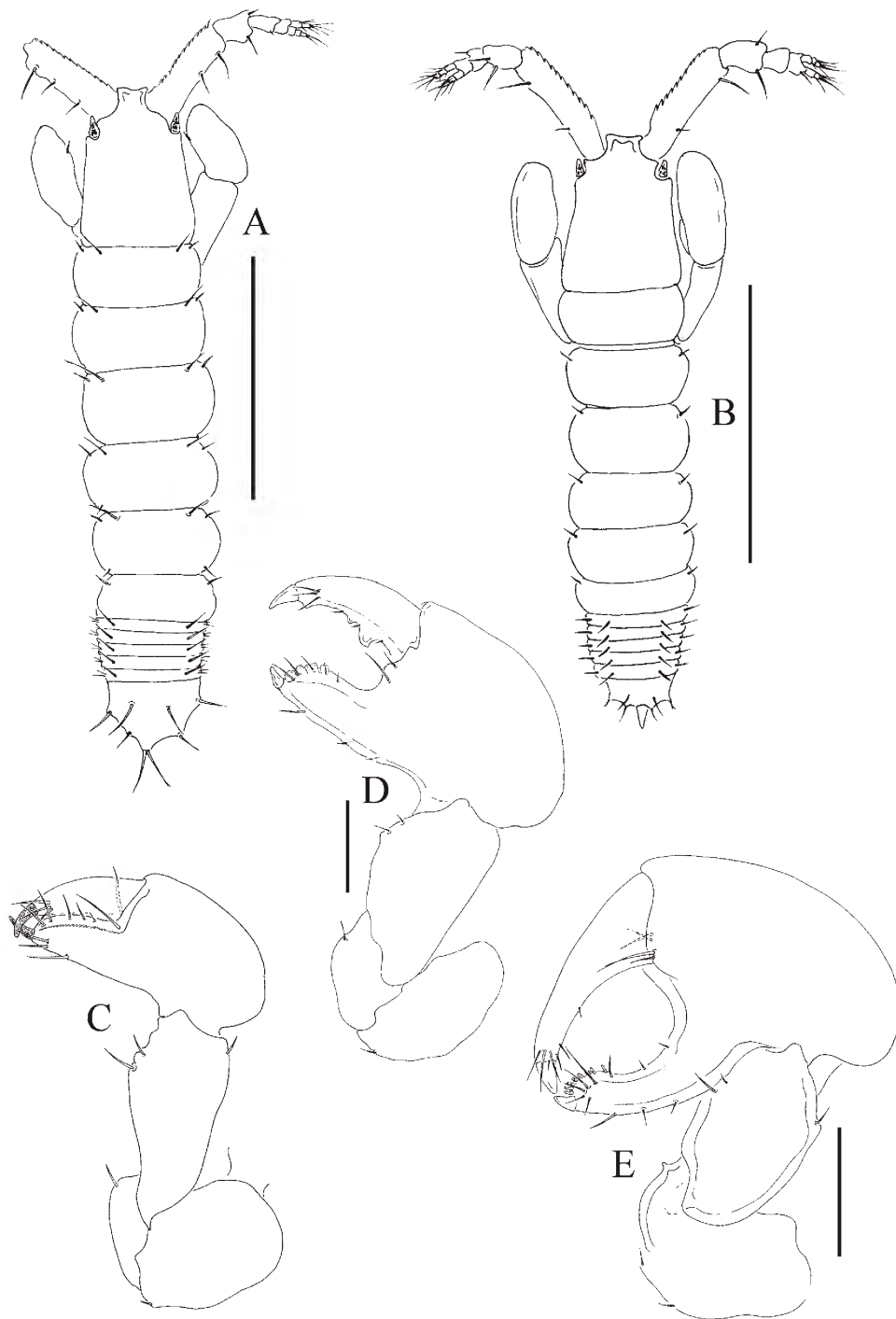


Figure 21. *Metapseudes wilsoni* sp. nov., A, holotype female, dorsal; B, male, dorsal; C, cheliped of female; D, cheliped of subadult male; E, cheliped of mature male. Scale line = 2.5 mm.

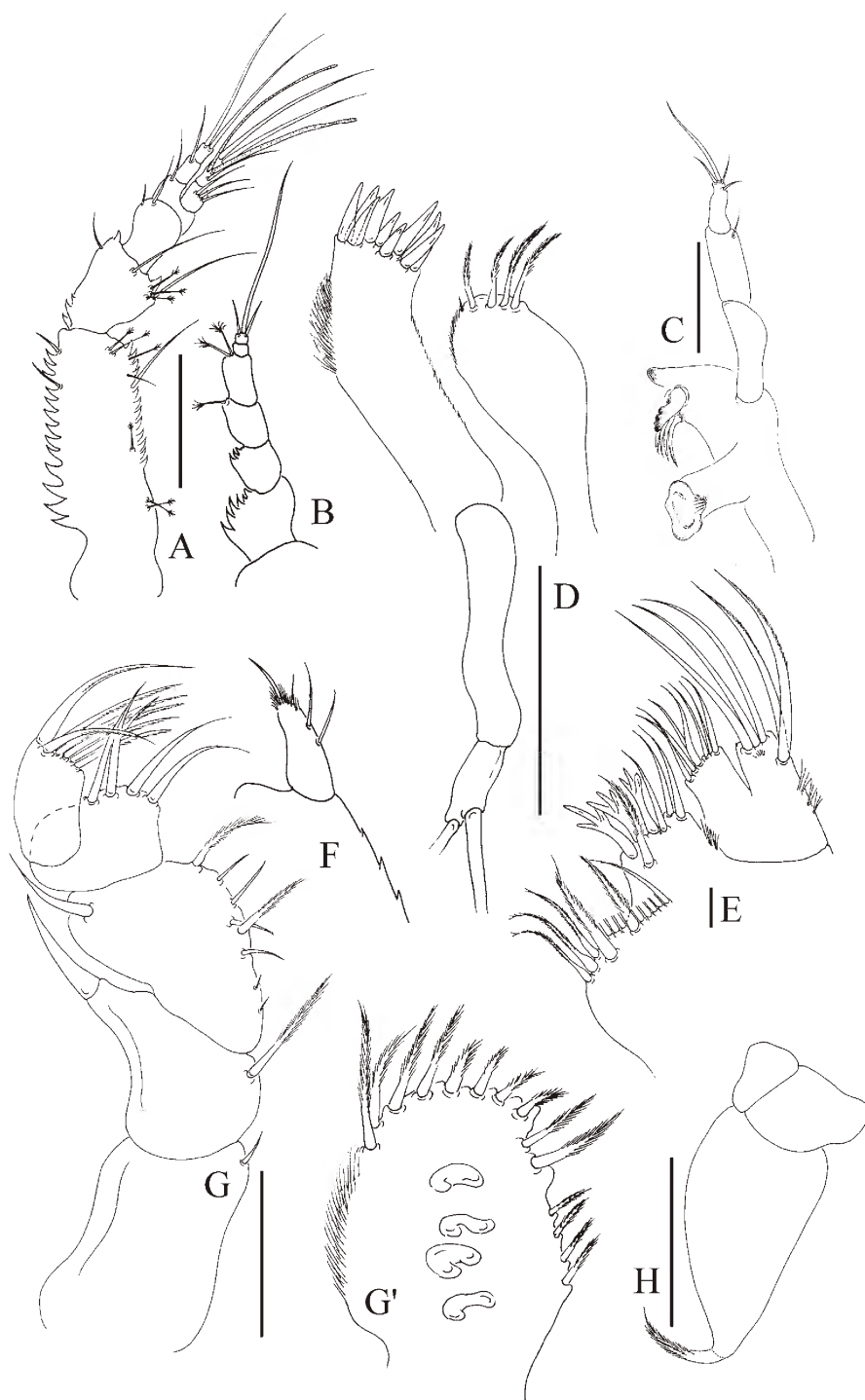


Figure 22. *Metapseudes wilsoni* sp. nov., A, antennule; B, antenna; C, left mandible; D, maxillule; E, maxilla; F, labium; G, maxilliped; G', maxilliped endite; H, epignath. Scale line = 0.1 mm.

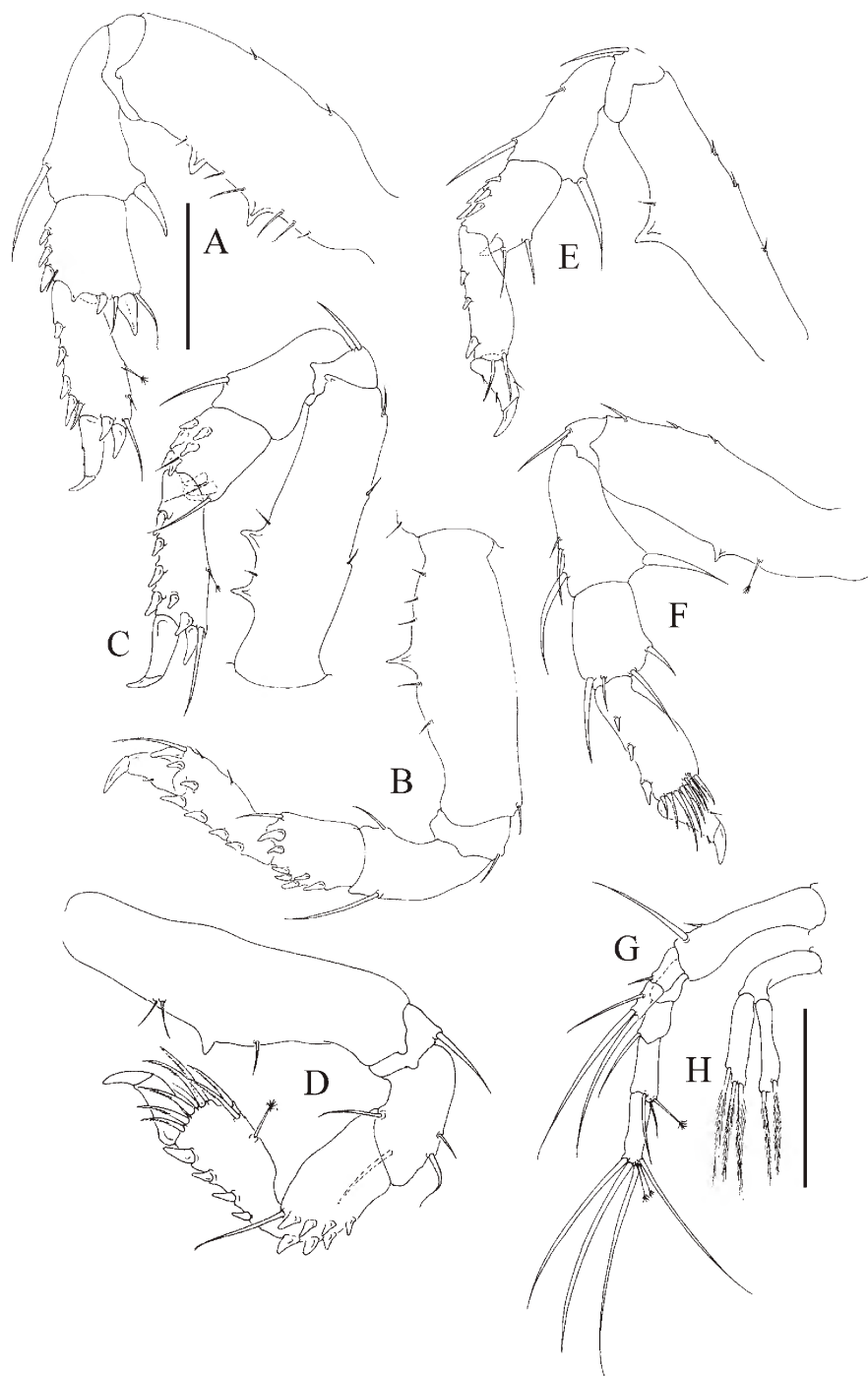


Figure 23. *Metapseudes wilsoni* sp. nov., A–F, pereopods 1–6 respectively; G, pleopod; H, uropod. Scale line = 2.5 mm.

1 outer subdistal seta. Right mandible as left. Maxillule inner endite with 5 finely setulate distal setae; outer endite with 8 distal spines and 2 subdistal setae, outer and inner margins finely setose; palp lost in dissection. Maxilla with fine setae on outer margin; outer lobe of moveable endite with 3 simple subdistal setae (1 mesially setulose) and 3 simple distal setae; inner lobe of moveable endite with 6 simple and 3 setulose setae; outer lobe of inner endite with 4 outer simple setae, 3 stout trifurcate spines, and 1 inner and 2 subdistal setulose setae; inner lobe of fixed endite with rostral row of 14 setae guarding 2 longer setae. Labium with smooth outer margin, palp with fine lateral setules and 3 simple distal spines. Maxilliped basis naked; palp article 1 with single distal seta on outer margin and long simple inner seta longer than article 2; palp article 2 longer than wide, with rows of numerous short setae and 6 longer simple setae along inner margin, outer margin denticulate and with single distal seta; palp article 3 as long as wide, with 8 simple setae along inner margin; palp article 4 with 7 distal setae and 1 subdistal seta. Endite with flagellate inner caudodistal seta and stout distal spines along setulose margin and three coupling hooks. Epignath not seen.

Cheliped robust, basis 1.8 times as long as wide, dorsally naked, ventrally with midventral spine and 2 plumose distal setae; exopodite present, 3-articled, article 2 naked, article 3 with 4 plumose setae. Merus subrectangular, with paired ventrodiscal simple setae. Carpus 1.25 times as long as wide, with 3 simple setae along ventral margin. Chela fingers shorter than palm, ventral margin of fixed finger with 6 setae; 1 seta near articulation of fixed finger; cutting edge with row of 6 setae but no apophyses, distal claw stout; dactylus naked with central and proximal apophyses on cutting edge, distal claw pointed.

Pereopod 1 with rounded spine-like apophysis on coxa bearing row of fine setules and 3 distal plumose setae. Basis stout, 2.3 times as long as wide, dorsal margin with 6 plumose setae but no apophyses, ventral margin with 6 plumose setae, 2 subdistal simple setae and ventrodiscal spine; exopodite present, 3-articled, article 2 naked, article 3 with 6 distal plumose setae. Ischium with 1 shorter and 2 longer simple ventrodiscal setae. Merus just over half as long as basis, expanded distally, with 3 ventral simple setae, ventrodiscal spine and adjacent simple seta and curved dorsodiscal spine and 2 adjacent simple setae. Carpus half as long as merus, with 2 ventral spines and intervening simple seta, dorsal margin with numerous simple setae and single dorsodiscal spine. Propodus as long as merus, with 4 ventral spines alternating with simple setae, 5 simple dorsal setae and 2 dorsodiscal spines. Dactylus stout, more than half as long as propodus, with mid-dorsal fine seta; unguis short.

Pereopod 2 more slender. Coxa with 2 plumose setae. Basis 2.6 times as long as wide with 2 dorsal and 3 ventral plumose setae, and 2 simple ventrodiscal setae. Merus 1.6 times as long as carpus, with elongate dorsodiscal plumose seta, 2 ventral simple setae and ventrodiscal spine. Carpus elongate, with 2 ventral spines and ventrodiscal seta, 3 dorsal simple setae and dorsodiscal spine. Propodus just longer than merus, with 4 ventral and 2 dorsodiscal spines with interspersed setae. Dactylus curved, with fine mid-dorsal seta, unguis slender.

Pereopod 3 similar to pereopod 2, but basis with longer mesial plumose seta, merus with 3 ventrodiscal spines, carpus with 2 dorsodiscal spines, propodus with 3 dorsodiscal spines.

Pereopod 4 similar to pereopod 3 but with no mesial seta on basis, longer anterior and posterior distal spines on carpus, propodus with mid-dorsal plumose sensory seta, dorsodiscal tuft of 4 shorter and 2 longer finely denticulate setae; dactylus with fine ventrodiscal seta.

Pereopod 5 similar to pereopod 4, basis with proximal penicillate setae and 4 dorsal plumose setae longer than basis width, 5 ventral plumose setae; ischium with 2 ventrodiscal setae, longer of which exceeds distal edge of merus; merus shorter than carpus, with plumose dorsal seta longer than carpus, 3 shorter ventral plumose setae and 2 ventrodiscal spines; carpus with ventral spines and distal crown of plumose setae; propodus with 2 plumose distal setae.

Pereopod 6 basis with 4 dorsal and 8 ventral plumose setae; merus with 3 dorsal plumose setae and 1 plumose and 2 simple ventral setae; carpus with 4 ventral and 3 dorsal plumose setae and dorsodiscal spine; propodus with 2 ventral spines and crown of 10 shorter and 1 longer distal setae.

Pleopods all similar, all setae plumose; basis with 1 ventral seta, outer ramus with 2 articles, proximal article with single outer seta, distal article with 3 outer and 3 distal setae, inner ramus with 8 setae around entire margin.

Uropod biramous, exopod just longer than proximal segment of endopod, of 2 segments, distally with 2 setae exceeding tip of endopod; endopod of 3 segments.

Etymology. From the Greek: *helios* – the sun, and *discos* – a flat circular plate or disc, with reference to the shape of the rostrum; noun in apposition.

Remarks. See the generic remarks above. The holotype has 8 eggs in its brood pouch.

Genus *Metapseudes* Stephensen 1927

Metapseudes wilsoni sp. nov.

Figures 20–23

Material. Ovigerous female, holotype (NVM J23601) Australia, Victoria, eastern Bass Strait, 11.2 km E of eastern edge of Lake Tyers (37°51.25'S, 148°13.10'E), 32 m, 25/09/1990, (MSL-EG 27), Marine Science Laboratories. Paratypes: 117 specimens including males and ovigerous females (NVM J55751), 2 dissected on slides (NVM J55939); same locality as holotype.

Description of female. Body not particularly dorsoventrally flattened, holotype 2 mm long (tip of rostrum to posterior of pleotelson), 4.9 times as long as wide. Cephalothorax subrectangular, 1.35 times as long as wide, naked; anterior margin with conspicuous square rostrum. Eyelobes and eyes present, with black pigment. 6 free pereonites, lateral margins uniformly convex, with paired anterolateral setae on each side; pereonites 1 and 2 subequal, about one-third as long as cephalothorax; pereonite 3 longest, 1.25 times as long as pereonite 1; pereonites 4 and 5 slightly shorter, pereonite 6 shortest, 0.8 times as long as pereonite 1 (all pereonites respectively 2.2, 2.3, 1.8, 2.0, 2.0 and 2.5 times as wide as long). Pleon twice as long as pereonite 5, of 5 free subequal pleonites bearing pleopods plus pleotelson; pleonites some 9 times as wide as long, not laterally expanded, with paired

dorsolateral and lateral setae. Pleotelson 0.75 times as long as wide, as long as pereonite 5, with single midlateral, subdistal and distal marginal setae on each side, and pair of mid-dorsolateral setae.

Antennule peduncle article 1 stout, 3 times as long as wide, with conspicuous denticulations along inner and outer margins, outer margin with longer subdistal seta and groups of proximal, mesial and distal penicillate setae; inner margin with 2 simple setae in distal one-third; peduncle article 2 0.3 times as long as article 1, with inner proximal denticulations, inner, dorsal and outer distal setae, and outer distal group of penicillate setae; article 3 one-quarter length of article 1, article 4 one-fifth as long as 2nd, with inner distal seta. Main flagellum of 2 segments, proximal segment with 3 simple distal setae, distal segment with 2 longer distal setae, 1 shorter subdistal seta and 2 aesthetascs; accessory flagellum of 2 segments.

Antenna peduncle article 1 with denticulate inner margin; article 2 distally denticulate on inner margin, naked, 0.7 times length of article 1; peduncle article 3 as long as article 2, with 1 inner distal penicillate seta; article 4 just longer than article 3, with 2 distal penicillate setae. Flagellum of 2 segments, distal segment with 2 shorter and 1 longer distal setae. Squama absent.

Mouth parts. Labrum not seen. Left mandible with narrow crenulated pars incisiva, lacinia mobilis as long as pars incisiva and distally crenulate, setiferous lobe with 4 simple setae, pars molaris elongate, stout, blunt with spinose extension at dorsal rim; mandibular palp of 3 articles, article 1 naked, article 2 as long as article 1 with dorsodistal seta, article 3 half as long as article 2 with 3 shorter and 1 longer distal setae, the longer as long as article 2. Right mandible as left. Maxillule inner endite with 4 setulate distal setae; outer endite with 9 distal spines, 2 shorter than the rest, outer margin finely setose; palp of 2 articles, article 2 one-third length of 1st and with 2 distal setae. Maxilla outer lobe of moveable endite with 2 subdistal and 4 distal simple setae; inner lobe of moveable endite distally with 7 simple setae; outer lobe of fixed endite distally with 3 simple outer setae and 3 trifurcate inner setae, subdistally with setulose seta; inner lobe of fixed endite with rostral row of 13 setae guarding 2 longer plumose setae. Labium with denticulate outer margin, palp elongate, with paired outer setae, fine distal setules and single distal spine. Maxilliped basis with simple inner distal seta; palp article 1 with outer distal spine on apophysis and single inner distal setulose seta; palp article 2 longer than wide, with sparse row of 6 simple and 2 setulose setae on inner margin, stout outer distal seta; palp article 3 0.6 times as long as wide, with 4 simple stout setae on inner distal margin; palp article 4 with 7 distally-denticulate distal setae. Endite with setulose distal and outer marginal setae, inner margin with fine setules, and 4 coupling hooks. Epignath elongate cup-shaped, with setulose distal spine.

Cheliped robust, basis as long as wide with small ventrodiscal seta; exopodite absent. Merus subrectangular, ventrodiscal shoulder with single seta. Carpus twice as long as wide, with simple dorsodistal seta, midventrally with paired simple setae among slight marginal crenulations. Chela fingers shorter than palm; palm with paired distal setae at articulation of dactylus; fixed finger with 3 ventral setae, cutting edge with sparse setae; dactylus with 3 distal setae, distal claw pointed.

Pereopods generally all somewhat similar.

Pereopod 1 basis compact, 2.7 times as long as wide, with simple setae and 2 triangular apophyses along dorsal margin, 2 fine setae on ventral margin; exopodite absent. Ischium naked. Merus 0.4 times as long as basis, with long inner distal seta and 1 outer distal spine. Carpus 0.8 times as long as merus, with 3 ventral spines, 2 dorsodistal spines and 3 distal simple setae. Propodus as long as merus, with 4 ventral spines, 2 stout dorsodistal spines, dorsodistal and ventrodiscal simple setae, and mid-dorsal penicillate seta. Dactylus stout, with fine midventral denticulation; unguis short, slender, one-third length of dactylus.

Pereopod 2 similar to but more slender than pereopod 1, basis 3 times as long as wide, dorsally with single triangular apophysis, ischium with single ventrodiscal seta, merus with single ventrodiscal and dorsodistal setae, carpus with 5 ventral short spines in 2 rows, and 2 mid-distal short spines; propodus 2.3 times as long as wide, with 4 ventral, 1 mesial and 2 dorsodistal short spines, and 2 fine dorsal and 1 longer dorsodistal setae; dactylus with ventral seta; unguis stout.

Pereopod 3 similar to pereopod 2, but dorsal margin of basis with 2 apophyses; merus dorsodistally naked.

Pereopod 4 similar to pereopod 2, but propodus with mid-dorsal penicillate seta, and dorsodistal tuft of 2 simple and 5 finely denticulate setae, more conspicuous "heel" on dactylus.

Pereopod 5 as pereopod 2 but with dorsodistal spine on merus, fewer spines on carpus and propodus, more conspicuous "heel" on dactylus.

Pereopod 6 similar to pereopod 5, but carpus without spines but with 4 distal simple setae, propodus with distal tuft of 8 finely denticulate setae.

Pleopods all alike. Basis naked, both rami slender, subequal in length, with 2 (exopod) or 3 (endopod) distal setae.

Uropod basis elongate, with 1 longer and 1 shorter outer distal setae. Exopod of 2 segments, endopod of 4 segments, setose as figured.

Male. Generally as female, body shorter (4.6 times as long as wide). Cheliped dimorphic, proportionately larger, carpus 1.6 times as long as wide, chela nearly twice as long as carpus, propodal palm 1.45 times as long as wide, fixed finger excavate to give wide separation from dactylus, cutting edge distally denticulate and setulose; dactylus longer than carpus. Cheliped of subadult male transitional, dactylus cutting edge with proximal rounded apophysis.

Etymology. Named for Dr Robin Wilson of Museum Victoria, who undertook much of the Bass Strait sampling.

Remarks. The only genus of the Metapseudinae without an antennal squama is *Metapseudes*; this genus is further distinguished from the others in having a simply setose trunk, no plumose setae on the basis of pereopod 1, and a simple rostrum. The only species previously known from this genus is *M. aucklandiae* Stephensen, 1927, described from New Zealand in shallow waters (Stephensen, 1927), and usefully redescribed from the type and other material by Gardiner (1973) (depth range 0–113 m). The 2 species have similar lateral dentition of the basal 2 articles of the antennule, rostrum, trunk setation, mouthpart morphology, pleopod and uropod morphology, no exopodites on the cheliped or pereopod 1 and, of course, no antennal squama.

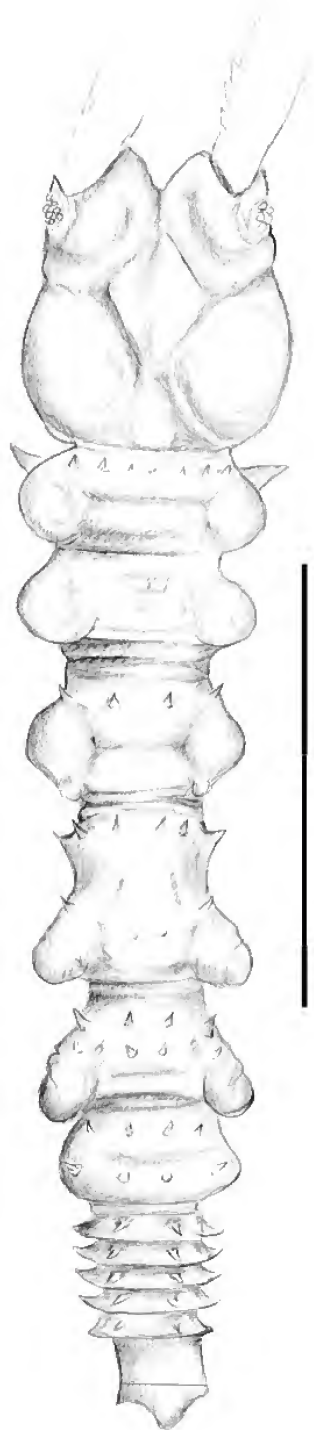


Figure 24. *Similipedia diarris* sp. nov., holotype female, dorsal. Scale line = 1mm.

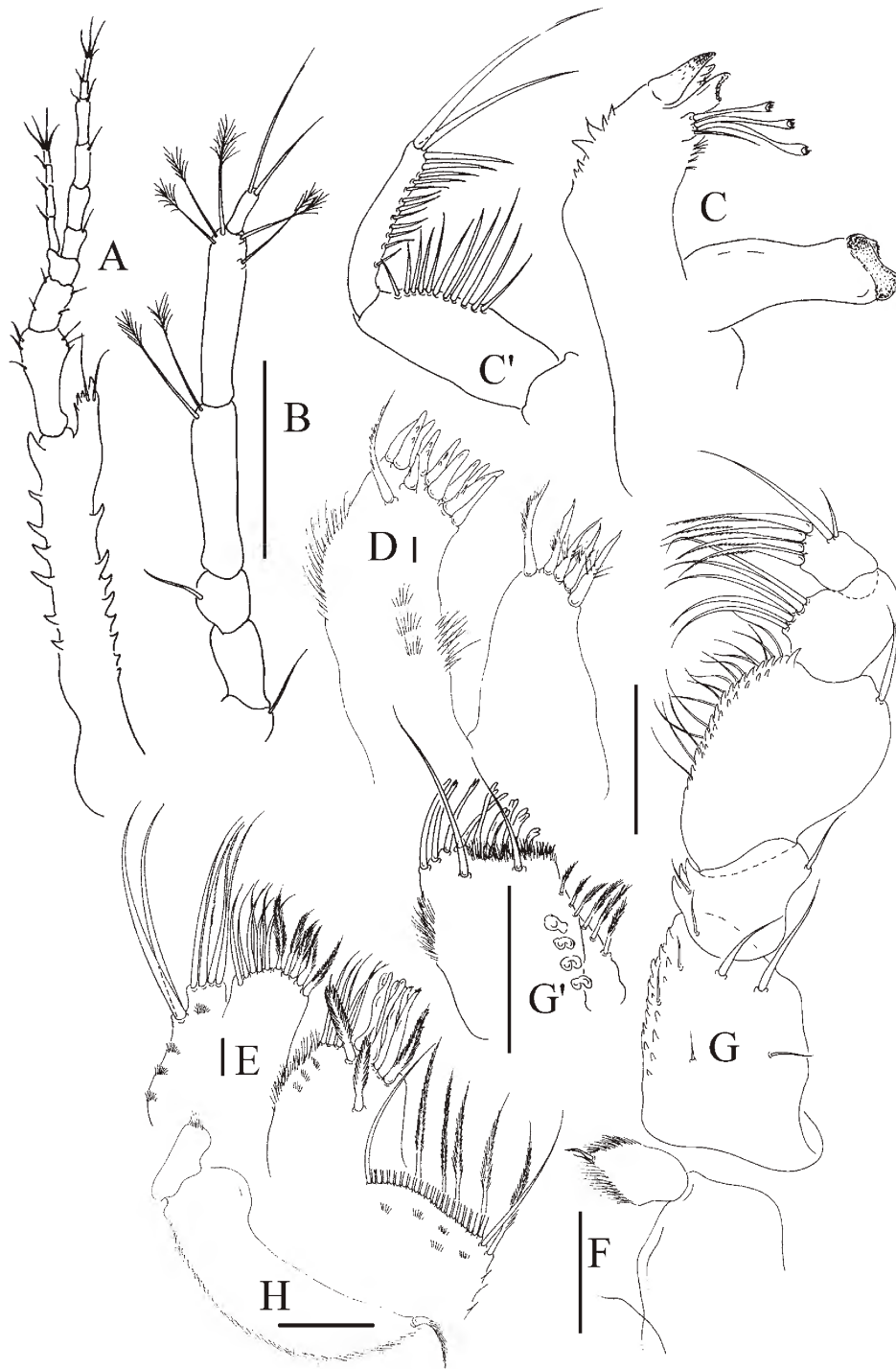


Figure 25. *Similipedia diarris* sp. nov., A, antennule; B, antenna; C, left mandible; D, maxillule; E, maxilla; F, labium; G, maxilliped; G' maxilliped endite; H epignath. Scale line = 0.1 mm.

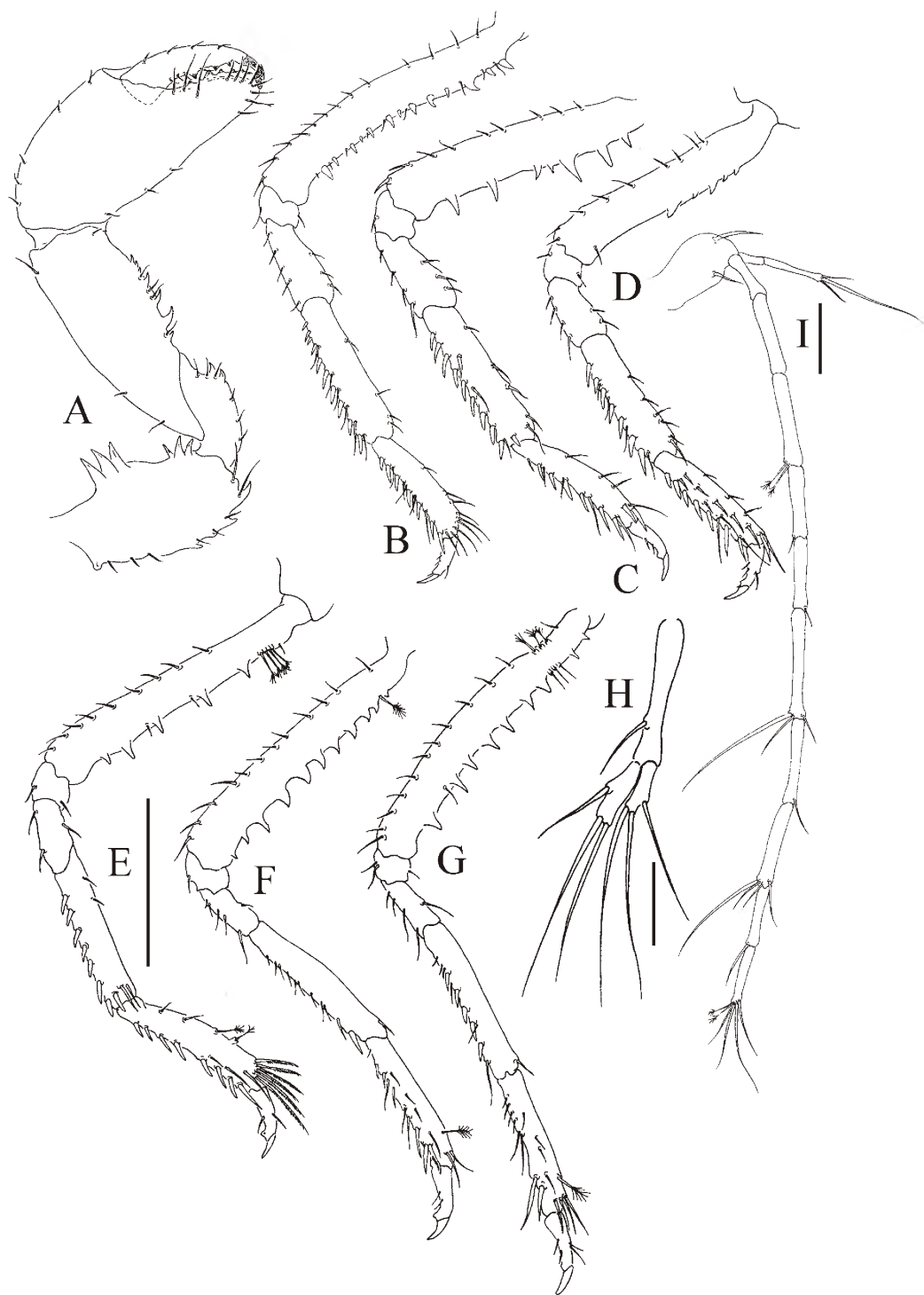


Figure 26. *Similipedia diarris* sp. nov., A, cheliped; B to G, pereopods 1 to 6 respectively; H, uropod; I, uropod. Scale line = 0.1 mm.

The most evident difference between these species is that *Metapseudes wilsoni* sp. nov. has conspicuously more slender antennules and antennae (proximal antennule peduncle article of *M. aucklandiae* 1.6 times as long as wide) with more pronounced, pointed denticulations on the proximal antennule peduncle article, and 1 fewer article in the main flagellum of the antennule (Stephensen, 1927, erroneously showed the 4th peduncle article split as 2 basal flagellar articles), but also 2 (rather than 1) distal setae on the maxillule palp, no indentation in the anterior margin of the rostrum, a more slender cheliped in the female (carpus of *M. aucklandiae* 1.7 times as long as wide), fewer dorsal apophyses on the pereopod bases, and a more slender pereopod 2 (propodus of *M. aucklandiae* about 1.2 times as long as wide).

Family **Pagurapseudidae** Lang 1970

Genus *Similipedia* Guţu 1989

Similipedia diarris sp. nov.

Figures 24–26

Material. Female, holotype (NMV J47126), Australia, Victoria, eastern Bass Strait, 8 km S of South East Point, Wilsons Promontory (39°12.54'S, 146°27.18'E), 65 m, 18/11/1981, (BSS 180 S), R.S. Wilson. Paratypes: 42 females (7 brooding), same locality as holotype; paratypes (NVM J55752), 2 dissected on slides (NMV J55938), same locality as holotype.

Description of female. Body dorsoventrally flattened, holotype 3.2 mm long (tip of rostrum to posterior of pleotelson), 5.3 times as long as wide, narrower posteriorly. Cephalothorax subrectangular, slightly longer than wide, naked, swollen around branchial chambers; anterior margin with conspicuous v-shaped rostral excavation. Eyes present; eyelobes with apophyses directed anterolaterally. 6 free pereonites; pereonites 1 and 2 subequal, about one-third as long as cephalothorax, lateral margins uniformly convex; pereonite 1 with anterodorsal row of 7 spiniform apophyses. Pereonite 3 1.5 times as long as pereonite 1, with 4 anterodorsal spiniform apophyses, lateral pair appearing as anterolateral apophyses; pereonite 4 longest, 1.7 times as long as pereonite 1, with 4 anterodorsal spiniform apophyses, anterolateral spiniform apophyses, mid-lateral spiniform apophyses anterior to conspicuous posterolateral swelling over coxal attachment; pereonite 5 just longer than pereonite 1, with anterodorsal and mid-dorsal rows of spiniform apophyses and expanded posterolaterally at attachment of coxae; pereonite 6 as long as pereonite 1, laterally uniformly convex with anterodorsal and mid-dorsal rows of spiniform apophyses (all pereonites respectively 2.4, 2.3, 1.6, 1.2, 1.9 and 1.8 times as wide as long). Pleon twice as long as pereonite 5, of 5 free subequal pleonites bearing pleopods plus pleotelson; pleonites dorsally convex, some 6 times as wide as long, laterally expanded by spiniform apophyses and with paired mid-dorsal spines. Pleotelson as long as wide, as long as pleonites 2 to 5 inclusive, naked.

Antennule peduncle article 1 elongate, 6.7 times as long as wide, with conspicuous inner and outer spine-like marginal apophyses, distally with inner tooth-like apophysis and larger

outer denticulate apophysis, as long as peduncle article 3 and bearing 2 setae; article 2 0.3 times as long as article 1, with distal expansion bearing 3 inner and 3 outer setae; article 3 three-quarters length of 2nd, article 4 one-third as long as 3rd, naked. Main flagellum of 6 segments, sparsely setose as figured; accessory flagellum of 4 segments.

Antenna peduncle article 1 simple with outer seta; article 2 naked, without squama; peduncle article 3 as long as wide, with 1 seta; articles 4 and 5 of equal length, and 3.3 times as long as article 3, each with distal penicillate setae. Flagellum of 1 segment with 2 distal setae.

Mouth parts. Labrum sparsely setose. Left mandible with distal outer margin bearing group of spinous apophyses; strong, bifurcate, crenulated pars incisiva, lacinia mobilis as long as pars incisiva, setiferous lobe with 1 simple and 3 longer, distally expanded and setulose setae, pars molaris elongate, blunt; mandibular palp of 3 articles, article 1 naked, article 2 twice as long as wide with inner row of 11 simple setae in distal half, article 3 as long as article 2 but more slender, 5 times as long as wide, with 12 inner simple setae increasing in length distally, and 2 longer distal setae, the longer 1.3 times as long as article. Right mandible as left but without lacinia mobilis. Maxillule inner endite with 5 midlaterally-setulate distal setae and outer marginal apophysis; outer endite with 11 distal spines, 1 shorter than the rest, outer margin finely setose, inner margin with microtrichia; palp absent. Maxilla with microtrichia on outer margin; outer lobe of moveable endite with 2 simple setae on outer margin and 4 simple distal setae; inner lobe of moveable endite distally with 7 simple outer and 5 plumose inner setae; outer lobe of fixed endite with marginal microtrichia, distally with 6 outer simple setae, 5 stouter blunt or bifurcate spines, and inner plumose seta; inner lobe of fixed endite with rostral row of 22 setae guarding 5 longer plumose setae, inner margin finely denticulate. Labium glabrous, palp marginally densely setose with single distal spine. Maxilliped basis with tuberculate inner margin, sparse short setae and 2 mid-distal setae; palp article 1 with single distal seta on outer margin, paired inner setae and 3 sharp denticulations on inner margin; palp article 2 longer than wide, with rows of numerous short tooth-like tuberculations on inner margin adjacent to row of small, simple setae, outer margin with 1 simple seta subdistally; palp article 3 as long as wide, with 5 simple setae on expanded inner margin; palp article 4 with 5 distally denticulate distal setae, and 1 longer and 1 shorter simple subdistal setae. Endite with simple, flagellate inner and outer caudodistal setae, blunt bifurcate or spatulate, distal spines, margin of dense fine distal setules and 4 coupling hooks. Epignath slender, marginally densely setose, with prominent proximal lobe and setose distal spine.

Cheliped robust, basis twice as long as wide, dorsally with central and distal groups of 3 spine-like apophyses, ventrally with small marginal setae, paired ventrodiscal setae and 4 denticulations along the distal half; exopodite absent. Merus subrectangular, ventrally and distally with sparse setae, ventrodiscal shoulder with 2 spine-like apophyses. Carpus 2.4 times as long as wide, with small, simple setae proximally and distally on dorsal margin, ventrally with spine-like apophyses becoming smaller distally and sparse simple setae. Chela

fingers shorter than palm; palm with sparse ventral (3) and dorsal (5) setae, fixed finger with 4 ventral and 4 dorsodistal setae around distinct distal claw, 3 setae near articulation of dactylus; cutting edge of fixed finger crenulate; dactylus with fine dorsal setae, proximal setae and distal apophyses on cutting edge, distal claw pointed.

Pereopods generally all similar.

Pereopod 1 coxa with spinous apophysis; basis slender, 6.4 times as long as wide, with simple setae along both margins and row of 12 spines along dorsal margin; exopodite absent. Ischium with single, simple ventrodistal and dorsodistal setae. Merus 0.3 times as long as basis, with rows of simple dorsal and ventral setae as figured. Carpus 1.8 times as long as merus, with sparse dorsal marginal setae, ventral margin with 10 spines interspersed with fine simple setae. Propodus shorter than carpus, 1.5 times as long as merus, with dorsodistal and distal simple setae, ventral margin with 7 spines interspersed with fine simple setae. Dactylus slender, one-third length of propodus, with fine inner and outer setae and slight ventrodistal expansion adjacent to unguis; unguis short, slender, half length of dactylus.

Pereopod 2 similar to pereopod 1, but basis 5.4 times as long as wide, dorsally with row of 7 unequal spine-like apophyses and no setae. Ventrodistal swelling on dactylus larger.

Pereopod 3 similar to pereopod 2, but dorsal margin of basis with fewer, smaller apophyses; propodus with mesial row of 5 setae.

Pereopod 4 similar to pereopod 2 but basis with dorsoproximal tuft of penicillate setae; merus half as long as subequal carpus or propodus; propodus with mid-dorsal penicillate seta, dorsodistal tuft of 6 finely denticulate setae; ventrodistal swelling on dactylus more pronounced.

Pereopod 5 as pereopod 4 but with only single penicillate seta on basis, mesial setae but only 2 simple distal setae on propodus.

Pereopod 6 similar to pereopod 5.

Pleopods all alike. Basis elongate, with single dorsal seta. Both rami slender, with 2 distal and 1 subdistal setae; endopod shorter than exopod.

Uropod basis with paired distal setae, endopod of 10 slender segments, exopod of 2 segments shorter than proximal 2 segments of endopod.

Etymology. From the Greek “*dia*” – asunder, and “*rhis*” – a snout, referring to the cleft rostral margin of the cephalon (noun in apposition).

Remarks. Within the subfamily Hodometricinae, only 3 genera, viz. *Pagurapseudopsis* Shiino, 1963, *Parapagurapseudopsis* Silva Brum, 1974 (including *Brumia* Băcescu, 1981), and *Similipedia* Guțu, 1989 have a full 5 pairs of pleopods in the adult. Of these 3, *Pagurapseudopsis* is distinct in having an exopodite on pereopod 1, and the basis of this pereopod is substantially larger than that of the remaining legs; *Parapagurapseudopsis* has an exopodite on the cheliped (rudiment only in *Pagurapseudopsis*); both of these genera have a palp on the maxillule. With no maxillule palp, pereopod 1 of similar morphology to the remaining pereopods, and exopodites missing from both the cheliped and pereopod 1, the present species accords with *Similipedia*.

The only previously described species of *Similipedia* is *S. eminescui* Guțu, 1989, from the north-east Mozambique Channel at 6 m depth, to which much of the morphology of *S. diarris* sp. nov. (habitus, rostral concavity, antennular basis apophyses, pereopod and pleopod structure, ventrodistal swelling on the pereopod dactyli) is very similar. The present species is distinguished from *S. eminescui* by having no squama on the antenna (very reduced squama evident in *S. eminescui*), no rostrum (small eminence in the centre of the rostral concavity in *S. eminescui*), dorsal spiniform apophyses on the pereonites (only setae in *S. eminescui*), more segments in the antennular flagella, 1 less segment in the antennal flagellum, more slender mandibular palp articles, and the more elaborate outer distal apophysis on the proximal antennule peduncle article.

None of the specimens of *Similipedia eminescui* had retained their chelipeds, so the description of the cheliped from *S. diarris* adds to our knowledge of this genus, particularly that the cheliped exopodite is absent. Guțu (1989) also gave no description of the maxilla of his species.

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